A

SYSTEM OF MEDICINE.

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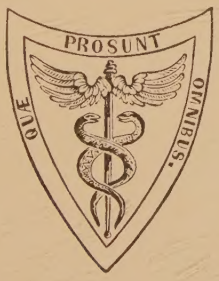
IN THREE VOLUMES.

VOL. III.

DISEASES OF THE DIGESTIVE, BLOOD-GLANDULAR, URINARY, REPRODUCTIVE, AND CUTANEOUS SYSTEMS.



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A SYSTEM OF MEDICINE.

LOCAL DISEASES (*continued*).

DISEASES OF THE DIGESTIVE SYSTEM.

A. DISEASES OF THE STOMACH.

By Wilson Fox, M.D. Lond., F.R.C.P.

Disorders of Function.
Atonic Dyspepsia.
Neuroses.
Acute Gastric Catarrh.
Chronic Catarrh.
Chronic Ulcer of the Stomach and Duodenum.
Cancer of the Stomach.
Hemorrhage.
Hypertrophy of the Walls.
Stricture and Obstruction of the Cardiac Orifice.
Obstruction of the Pylorus, with Dilatation.
Softening.
Perforation.
Rupture.
Tubercle.

I.—Disorders of Function.

The disturbances in its physiological functions which characterize disorders of the stomach present but few characteristic features by means of which those arising from other than organic diseases can be distinguished from those depending on anatomical alterations in its coats. The significance of the symptoms met with must therefore, in the majority of cases, be estimated from the concomitant circumstances by which they are attended, and their treatment must vary with the causes on which they depend. It is not, however, unimportant that these should be briefly reviewed, and in the present chapter some consideration will be given to the causes of such derangements. Their diagnosis and treatment will, however, be more appropriately considered in the subsequent sections which relate to the disorders in which they originate.

A. Sensation.—*Pain* in the stomach has received various names, the most common of which are Cardialgia, Gastrodynia, or Gastralgia.[1]

[1] These terms have been applied with such varying meanings by different writers, that it is scarcely correct to speak of them as strictly synonymous, except as being expressions of the common element of perverted sensation. The first two are in most common use in this country, where Cardialgia is more commonly identified with *Acidity* or *Heartburn* (Copland, Dict. ii. 329; Cullen, loc. cit. ii. 465), and Gastrodynia with *Pain*, in the strictest sense of the word. On the other hand, in France and Germany (Georget, Dict. de Méd. art. "Gastralgia;" Romberg, Dis. Nerv. Syst. i. pp. 104, 129; Bamberger, Krank. der Chylopoiet. Syst. 163) Cardialgia (which is the classical expression of the older writers, Hoffmann, J. Frank, Schmidtmann, and Trnka) is used for the severer forms of pain, associated with intense depression and faintness, and is sometimes further limited to those of paroxysmal and spasmodic character; while Gastrodynia is employed for pain of less severity, but more continuous in character. The term Gastralgia, very little em-

The subjective sensations embraced under these terms present all possible variations of degree, severity, and duration, from a vague sense of uneasiness to intense and almost unendurable suffering.

The *seat* of pain, originating in the stomach, presents some remarkable differences. Ordinarily it is epigastric or post-sternal; but it may be felt in the hypochondria or in the umbilicus. Dyspeptic disturbances are frequently associated with pain or tenderness in the dorsal and thoracic muscles, especially about the shoulder-blades. Cancer and ulcer are also very commonly associated with severe dorsal pain, and in some cases more distant neuralgias[1] are attributable to these causes.

There can be little doubt that the mucous membrane of the stomach, though ordinarily possessing but little sensibility, may have this increased under the influence of disease, though the variations in its manifestation under such circumstances are not always explicable. There appear also to be at least two distinct methods through which painful sensation can be produced in this organ; and when it can be made practically available, this distinction is of some importance as a clue to treatment. Thus in one set of cases it may be referred to the direct agency of the sensory nerves of the mucous and submucous tissues; in another, cramp or spasm of the muscular coat may be the determining cause of pain of considerable intensity; while, in a third class, the coexistence of both becomes a matter of great probability.

The conditions of the stomach giving rise to pain may be summarily expressed as follows:—

1. The presence in its interior of foreign substances of an irritating character.
2. Organic diseases altering the anatomical structure of its coats.
3. Perversions of its secretions.
4. Perversions of innervation:
   - *a*. Proper to stomach.
   - *b*. Reflected from other organs.
   - *c*. Originating in the nervous centres.

1. Foreign bodies usually appear to cause pain through exciting spasm of the muscular coats;[1] and this explanation is probably applicable to the pain arising from indigestible food being swallowed, or from bile regurgitating from the duodenum, or from flatulent distension by gas, or from acrid substances arising from fermentation. Sharp substances, on the other hand, may directly injure the nerves of the organ;[2] and the pain arising from corrosive poisons is probably in great measure due to this latter cause.

2. Inflammation, unless when of great intensity, or when caused by corrosive poisons, or when accompanied by aphthous ulcerations or hemorrhagic erosions, seldom causes pain of extreme degrees of intensity. Very considerable epigastric uneasiness and distress often, however, attend this process; so that this distinction is only of comparative value.

Cancer and chronic ulcer are amongst the most frequent sources of severe and continuous pain in the stomach. Their prominence in this respect depends in great measure on the invasion of large branches of nerves in the destructive processes which they occasion, or in cicatricial contractions resulting from these, and also on spasmodic action of the muscular coats, resulting from obstructions of the pylorus, and further on the irritating secretions to which they may give rise. They may, however, in exceptional cases proceed to a fatal termination without any appearance of this symptom.

Diseases of the pyloric orifice are causes of pain through the spasmodic contractions which they occasion, as well as by the flatulent distension resulting from the fermentation of the food thus delayed in the stomach.

3. Perverted secretions, when acid, may give rise to pain from their irritating qualities. In some instances, however, the symptom attends the secretion of neutral fluids; and in either case it is probably questionable whether both the secretion and the disordered sensation are not common expressions of a more general cause affecting the innervation of the

ployed in this country, is used in France to signify a much wider range of phenomena, but all embracing various forms of uneasiness observed during the digestive process. Barras (Traité sur les Gastralgies et les Enteralgies) defines it in terms corresponding to the "morbid sensibility of the stomach" of Johnson; but, under the theory of the neurotic origin of Dyspepsia, he applies to it almost all forms of indigestion not having an inflammatory or an organic cause. See also Valleix, Guide du Médecin Pract. iv. 3.

[1] As of the fifth nerve; Andral, Clin. Méd. ii. 158.

[1] Beaumont, loc. cit. 105, 228, 229, found that cramp-like pain was excited by passing the thermometer into the pylorus in Alexis S. Martin's stomach; but in other cases of Gastric Fistula the sensations produced by touching other portions of the stomach, appear to have been rather those of sickness or faintness than of actual pain. Murchison, Med.-Chir. Trans. xli. 16.

[2] See a case quoted from Velpeau by Dr. Budd, of a fork swallowed, Dis. of Stomach, p. 276. Also a case by Mr. Marshall, where a number of pins were found in the stomach, Med.-Chir. Trans. xxxv. Also a case by Marcet (Med.-Chir. Trans. xii.), of a man who, on several different occasions, swallowed a number of clasp-knives.

stomach. The fallacy of confounding acidity from hypersecretion with that arising from fermentative processes must also be guarded against; in the latter case the pain is often caused by spasmodic contraction, arising from flatulent distension.

4. Pain of a purely nervous origin, unattended by undue muscular spasm from flatulent distension, or by perverted secretion, is a comparatively rare event in the history of disorders of the stomach.

Such cases will be more fully alluded to hereafter, when it will be seen that they most commonly occur in cases of hysteria and hypochondriasis, or in patients of a rheumatic or gouty diathesis, or are produced by reflex disturbance originating in other and distant parts. (See chapter on the Neuroses of the Stomach.)

It is an uncertain point whether the nerves which are affected in these cases are the branches of the vagus or of the cæliac axis.[1]

In many cases, especially of chlorosis, the neuralgia appears to depend on the general condition of the system, disappearing with improvement in the state of the blood.[2] Direct evidence of pain of this class originating in the central organs of the brain or cord is rarely afforded,[3] though the absence of any demonstrative cause may at times lead to the suspicion of such a mode of causation. Many also of the painful sensations felt in the stomach are directly due to derangements in other organs. Among those which most frequently produce this effect are especially to be mentioned disorders of the uterus and ovaries, and many severe cases of gastrodynia are connected with disturbance of the menstrual function.[4] To these must be added gall-stones, diseases of the duodenum, abdominal aneurism;[5] and pericarditis.[6]

Diagnosis.—The difficulty in the distinction of pain of neuralgic or spasmodic origin from that originating in organic diseases is very considerable. It will be more fully dwelt upon hereafter under the diagnosis of those affections. It may be sufficient here to mention that neuralgic pain is most common in the earlier periods of life, and in the female sex (in whom it is usually associated with uterine disturbances, and also with other nervous phenomena), that it affects but little the function of digestion, and that it is often most felt when the stomach is empty. Pain felt after food has a gravity commonly proportioned to the time which has elapsed before it is perceived. If occurring late, it may be due to flatulence; but pain of any severity, occurring early, and continuing long after the ingestion of food, and particularly when it is relieved by emptying the stomach, is always to be regarded with suspicion of its origin in organic disease. Pain of a continuous character and of a fixed site has also graver features than that which is more migratory and intermittent.

The indications obtained by pressure are of some value in elucidating the cause of pain. That arising from ulcer, cancer, and also the uneasiness felt in inflammatory states of the stomach, is generally, but not invariably, aggravated by this proceeding.[1] Pain of nervous origin, and that arising from flatulent spasm, is, on the other hand, usually relieved by pressure firmly exercised.

Some affections which simulate gastric pain deserve a brief notice:—

(*a*) Pain in the abdominal muscles has been shown by Briquet[2] to be frequently mistaken for severe gastrodynia. He states that it is distinguished by a superficial tenderness, by its preferential seat in the left recti and obliqui abdominis, by its affecting not only the fleshy parts, but also their tendinous attachments, and by its being frequently accompanied by dorsal pain, and by tenderness on pressure in the vertebral groove (rachialgia, Briquet). He is of opinion that it may exist independently of any affection of the stomach, though it may occasionally be excited by reflex sympathy,[3] when this organ is diseased.

(*b*) Rheumatic pains of the abdominal muscles are another source of fallacy.[4]

[1] Romberg, Dis. Nerv. Syst. Bernard found that after division of the pneumogastric nerves the mucous membrane of the stomach became insensible to pinching (Lec. Syst. Nerv. ii. 424).

[2] Niemeyer, Lehrb. Path. Therap. i. 545.

[3] See a case by Bamberger, loc. cit. 168.

[4] See Neuroses of the Stomach.

[5] Lebert, Handb. der Spec. Path. Therap. (Virchow), vol. v. Abth. ii. p. 58.

[6] Andral, Clin. Méd. ii. 148.

[1] Much in these cases depends on the seat of the disease.

[2] Traité Clinique et Thérapeutique de l'Hystérie, 1859, p. 216 et seq.; termed by him "Myosalgia" and "Epigastralgia" (corresponding to the Myalgia of Dr. Inman, "Spinal Irritation").

[3] This opinion is in some degree corroborated by Bernard's observation, that pricking the solar plexus and semi-lunar ganglion caused involuntary movements of the pectoral and abdominal muscles and of the diaphragm (Lec. Syst. Nerv. i. 368). I have met with unequivocal tenderness in the muscles of the vertebral groove and in the abdominal muscles in cases of gastric ulcer. Traube also has noticed both hyperæsthesia and anæsthesia of the cutaneous surface in cases of ulcer (Deutsche Clinik, 1861, p. 63).

[4] Bamberger, Krank. Chylopoiet. Syst. 171.

They are distinguished both by superficial tenderness and by pain on movement.

(*c*) Epigastric pain has also been observed in cases of functional or organic disease of the spinal cord. In the former class of cases, when affecting the skin, it is distinguished by the very superficial tenderness, which disappears on deeper pressure,[1] by the discovery of other painful points in the course of the nerves affected, by the absence of all symptoms referable to the stomach, and by the coexistence of an hysterical diathesis: the distinctive characters of pain affecting the muscles have been already referred to. In the latter class the presence of spinal tenderness, as ascertained by cold, heat, pressure, &c., the coexistence of some perversions of the functions of sensation or of motor power in the lower extremities, and even, in the absence of the latter, the symmetrical character of the affection,[2] and the relief by rest, will generally suffice to indicate (in the absence of symptoms referable to the abdominal viscera) the nature of the affection.

(*d*) Pain in the transverse colon frequently simulates that arising from the stomach. It is often associated with an amount of flatulent distension which may add greatly to the difficulties of diagnosis of its seat. There is, however, generally a distinct difference, especially on gentle percussion, between the notes to be elicited from the two organs; that arising from a distended colon being the less prolonged, and having a higher pitch. Pain also from this source is seldom so much felt at the ensiform cartilage as in the right or left hypochondriac regions, and it frequently extends in the direction of the sigmoid flexure. It is also associated with colicky pains and with irregular contractions, which may be seen or felt by the hand, and with borborygmi, distension, and other signs of intestinal flatulence, and with migratory pains in other parts of the abdomen.

B. Movement.—Of the functional disturbances in the movements of the stomach, *spasm* has been already alluded to as a cause of pain.

Paralysis of the muscular coat from over-distension or from impaired innervation is one of the causes of Dilatation of the Stomach, and will be referred to under that head.

Vomiting, the other derangement coming under this head which most demands attention, may, like pain, originate from causes intrinsic or extrinsic to the stomach, and it may be conveniently classified according to its origin from sources of peripheral irritation either of the stomach or of other viscera, or from disturbed action of the central organs of the nervous system.

As a reflex act it may arise from irritation of the nerves supplying the stomach and fauces, or of other and distant parts which have no direct apparent connection with these in their sources of nervous supply. The former scarcely need further illustration, since they are familiarly known, and will be repeatedly alluded to hereafter. The latter require to be borne in mind as sources of error in diagnosis regarding the origin of this symptom. Among the disorders of other organs which most commonly produce it are those of the uterus[1] and ovaries, and of the testicle, renal and biliary colic,[2] hepatic abscess,[3] peritonitis, ulcerations,[4] invaginations, hernia, or other obstructions of the intestines, epiploic hernia,[5] and paroxysmal cough.

Vomiting from cerebral causes may arise from cerebral anæmia,[6] and also from nearly all the known disorders or mechanical injuries of the brain, independently of the part affected, as well as from some whose nature is less distinct, as in some cases of commencing paralysis after diphtheria.[7] It is a common symptom at the commencement of apoplectiform attacks in elderly people,[8] and it occurs with great frequency in tubercular meningitis.

Certain toxic agents acting through the nervous centres also produce it,[9] and in

[1] This is, however, a peculiarity of some forms of pain undoubtedly originating in the stomach, and which cannot, therefore, be relied upon.

[2] Hilton, Lectures on Rest and Pain, pp. 79, 80.

[1] The irritability of the stomach in affections of the female genital organs, so constantly illustrated by the state of pregnancy, should, in cases of doubtful origin, never be overlooked by the practitioner. In a case related by Gooch, from Denman's Experiences, vomiting followed each attempt to tighten a ligature round an inverted uterus, and ceased as soon as the ligature was slackened. Dis. Women and Children, New Syd. Soc., p. 137.

[2] Budd, Dis. of Stomach.

[3] Ib. p. 192.

[4] The author has known severe vomiting depend on this cause.

[5] Chomel, Des Dyspepsies, pp. 133, 134.

[6] Marshall Hall, Med.-Chir. Trans. xiii. Kussmaul and Tenner on Convulsions, New Syd. Soc. pp. 28–30.

[7] Sir W. Jenner on Diphtheria, p. 42. In these cases, from the simultaneous affection of the heart, there was reason to believe that the roots of the par vagum were probably affected.

[8] Abercrombie's Second Form of Apoplectiform Attack.

[9] Tobacco, digitalis (Clarus, Arzeneimittellehre, 596; Andral, Path. Interne, i. 147),

the same category must be placed the influence of many disordered conditions of the blood, as in uræmia and in the invasion of the acute diseases,[1] and in the cold stage of intermittents.[2]

It is also associated with other and purely functional disorders of the nervous centres, as when arising from shock or fright. It is a frequent accompaniment of the hysterical diathesis, to which more special allusion will be made hereafter. It is easily excited also by affections of the senses, as by severe pain, by objects nauseous or disgusting to the sight, taste, or smell, or even by the idea of these, and by a bright light. The sight of objects in motion also produces the symptom, in some people. Swinging movements of the body are also capable, when continued, of giving rise to vomiting, with various degrees of facility in different persons; and both of the last-named causes probably combine to produce the phenomena of sea-sickness, which is in many very closely imitated by the effects of riding in a carriage, and especially by riding backwards.

The diagnosis of vomiting arising from disease of the stomach from that depending either on cerebral or on reflex causes is at times very important, lest a grave disease in some other organ be overlooked through the attention being directed solely to the symptoms presented by the stomach. The criteria of the latter class are often by no means distinct, and the origin of the symptom can only be elucidated by a careful investigation of the concomitant circumstances. In some of these cases, however, the vomiting resembles that arising from cerebral causes.

Among the chief differences observable between vomiting arising from the latter cause and that depending on irritation of the stomach, the following deserve attention.

Vomiting arising from disorder of the stomach is usually preceded by nausea, and is attended by more or less epigastric pain and oppression and uneasiness, together with other signs of derangement of the digestive system, such as constipation or diarrhœa, a loaded tongue, and thirst. Moreover, the nausea and vertigo which precede or accompany it are usually relieved by the act of vomiting.

Vomiting from cerebral causes is often unattended by nausea, but vertigo or pain in the head is very common, and both these symptoms are rarely relieved by the vomiting. There is commonly no epigastric pain[1] or uneasiness. The tongue is often clean.

Other cerebral symptoms are also usually superadded, such as pain,[2] diplopia or indistinctness of vision and alteration of the pupils, confusion of ideas, loss of memory, anæsthesia or some form of paræsthesia, spasm, convulsions, paralysis, or coma.

The indications obtainable from the matters vomited vary considerably in their diagnostic value. Blood will be more fully considered hereafter. Food may either be returned unaltered, as in some cases of nervous vomiting, where it is ejected almost as soon as it is swallowed; or it may present evidences of fermentative changes, varying with the length of time during which it has been delayed in the stomach, but which more particularly affect the starchy substances. These are in some cases changed into a tenacious glutinous material, resembling some of the products derived from the lactic acid fermentation,[3] while in others they are found to be frothy from the evolution of carbonic acid, and associated with the formation of large quantities of the *Torula cerevisiæ*.[4] In other instances alcohol[5] has been found, together with amylic alcohol and the butyric, lactic, and acetic

Fig. 1.

A. Sarcina ventriculi. *B.* Torula cerevisiæ.

opium, cyanide of potassium applied externally (Andral, Clin. Méd. v. 270), lobelia, and the vapor of chloroform. Majendie's experiment, by which vomiting was induced in a dog after a bladder had been substituted for the stomach, by means of injection of tartar emetic into the veins, would appear to show that this agent has a similar effect.

[1] Typhoid fever, pneumonia, and scarlatina are among the most common of these. [In smallpox, yellow fever, and remittent fever, vomiting is frequent. In pericarditis, especially in children, it is not uncommon.—H.]

[2] Henoch, Unterleibs Krankh. ii. 337. Habershon, Obs. Alimentary Canal, 140.

[1] Exceptional cases occasionally occur. Some of these have been quoted by the author in a former work, Diagnosis and Treatment of Dyspepsia, p. 60.

[2] Disorder of the stomach is often accompanied with severe cerebral pain, especially under the form of sick-headache, which is sometimes associated with much intolerance of light. It is, however, usually relieved by vomiting.

[3] Frerichs, in Wagner's Handwörterbuch der Physiologie, art. "Verdauung," p. 804.

[4] Ibid.

[5] Graham, quoted by Sir William Jenner, Med. Times and Gaz., Aug. 1851, p. 192; also Schulzen, Arch. Anat. Phys. 1864, pp. 491–498.

acids. These changes occur in the most extreme degree when the food is delayed in the stomach by obstructions at the pyloric orifice, under which circumstances the *Sarcina ventriculi* of Goodsir is found in the scum which rises on the surface. This growth assumes the form of oblong plates, divided by dissepiments into four secondary, sixteen tertiary, and sixty-four elementary square cells, which measure from $\frac{1}{800}$ to $\frac{1}{1000}$ of an inch along each of their sides; and from the arrangement thus described it received the name of *sarcina* or woolpack, given to it by its discoverer.[1]

Though, however, for the reasons just stated, its appearance is most common in cases of pyloric obstruction, it is by no means pathognomonic of this condition. It has been found in many other diseases of the stomach, occurring in several cases of direct injury to this viscus,[2] and in some instances where digestion was probably affected by impaired innervation, and when no lesion of the organ has been discoverable.[3] It occurs also in cases of catarrh of the stomach,[4] and probably in other conditions when fermentative action is constant or frequent, though it appears to be doubtful whether it is capable of causing this action.[5] Its generation in the stomach appears to be mainly associated with an acid form of fermentation (Budd); but it has been found in other tissues and fluids of the body,[6] though the conditions of its formation under these circumstances have not been fully explained.

[1] Ed. Med. Surg. Journ. vol. lvii. The growth appears to be identical with the *Merismopœdia punctata*. (Mettenius, Zeitsch. Rat. Med. vii. 355.) It is termed *Merismopœdia ventriculi* by Robin.

[2] Mr. Busk, Microscop. Journ. 1841, i. 321; Sir W. Jenner, Med. Times and Gaz. Aug. 1851, p. 192 (Sir W. Jenner's case was probably one of pyloric coarctation resulting from the cicatrization of an ulcer); Budd, Diseases of Stomach.

[3] Busk, loc. cit.; Dr. J. W. Ogle, in a case of Tubercular Meningitis, Path. Soc. Trans. vi. 17.

[4] Dr. Bence Jones, in a case of vomiting from albuminuria, Path. Soc. Trans. iii. 328.

[5] Virchow, Archiv, i. 271. Kühne, Lehrbuch der Phys. Chemie, p. 59, says that he has kept sarcinæ with vomited matters, and also with solutions of sugar, for days, without the slightest development of gases ensuing.

[6] In the lungs, by Virchow, Froriep. N. Notizen, 1846, No. 825; Archiv für Path. Anat. x. 401; also by Zenker, Zeitsch. Rat. Med. N. F. iii. 117. In the urine, by Heller, Archiv Chem. Microscop. 1847, 1852. Also in the pelvis of the kidneys and in the bladder, by Mr. Hepworth, Microscop. Journ. v. 2, 3; and in the bile, by Dr. Lionel Beale (quoted by Dr. Budd, loc. cit.).

Independently of food, other matters vomited are sometimes of value in the indications which they afford of disease of the stomach. Thus mucus is almost invariably an evidence of catarrhal conditions; while with respect to other fluids, whether acid or alkaline, the chief conditions under which they are secreted are alluded to under the heads of Pain and Acidity.

Bile commonly appears whenever the straining is long and violent; it is not therefore indicative of any special disease, though its presence in the stomach serves at all times to retard the digestive process.

Pus, as such, does not appear to be formed in the stomach, except in those rarer instances where suppuration takes place in the submucous coat; and its presence in vomited matters is therefore generally indicative of its having been formed in the œsophagus, or that it has entered the stomach from some source external to that organ.[1]

Vomiting of foreign products, such as worms or echinococci, are among the rarities of medical literature: in the case of the latter their appearance would be indicative of a communication having been established between the cavity of the stomach and an echinococcus cyst in some other organ.

It is believed by some practitioners that cancer cells can be distinguished among the products of vomiting when the disease affects the stomach. I know of no authentic instance where such an observation has been made of an indubitable kind;[2] while the improbability that any portion of a cancer would be separated in a condition in which its cells would still present their distinctive characters, coupled with the fallacies presented by the appearances of swollen epithelial cells from the stomach, or from the buccal, pharyngeal, or œsophageal surfaces, should cause such evidence to be received only with the greatest care and caution.

Dr. Quain and Mr. Beardsley have, however, recorded a case where a polypoid growth having all the characters of those ordinarily found in the stomach was ejected entire;[3] but the pedunculated growth of these formations would allow

[1] See a case of this nature, where pus was vomited from a fistulous communication between the œsophagus and pericardium, Dr. Chambers, Indigestions, p. 175. The same author says that he has seen this product in matters vomited in cases of cancer of the œsophagus and cardia.

[2] Lebert, Traité des Maladies Cancereuses, p. 304, says that these have been observed by M. Schoenhein (Qy. Schönlein), but gives no further particulars.

[3] Trans. Path. Soc. viii. 219.

of their separation with much greater ease than in the case of cancers, portions of which are ordinarily only removed by sloughing processes, which destroy the characters by which they can be recognized.

Fecal vomiting can as a rule only occur under conditions either of direct communication of some portion of the intestine (usually the colon) with the stomach, or as the result of obstruction to the passage of the feces through the intestines. Briquet has, however, recorded a case, observed under circumstances where all possible precautions appear to have been taken to guard against imposition, and where a hysterical patient speedily vomited matters introduced into the rectum.[1]

The contents of the stomach are sometimes ejected by the simple contraction of its coats, without the participation of the abdominal and thoracic muscles; and to this process the name of *eructation* has been applied. Gas is very commonly ejected in this manner, and it is often accompanied by small portions of food. Acid or neutral fluids are also frequently thus brought into the mouth.[2] The vomiting of infants very closely resembles this process, as from the shape of the stomach in infancy its contractions have a greater tendency to force food through the cardia than is the case in the adult, when it is propelled into the fundus. This effect under any circumstances is commonly due to undue irritation or to excessive distension of the organ, and therefore is very common when food is swallowed without due mastication. In some persons the continuance of the habit has led to a habit of *quasi-rumination*, the food thus brought up being subjected to a second mastication before it is swallowed.[3]

C. Secretion. — Alterations in the secretions of the stomach may be classified under the categories of excess, deficiency, or perversion.

It must, however, be remembered that secretions both of an acid and also of an alkaline character are normal products of the mucous membrane: the former being furnished by the glands situated in the fundus and body of the organ, which are lined by a spheroidal epithelium, and which furnish the true gastric juice; the latter by those of the pyloric region, whose epithelium is columnar, and whose products, having the characters of ordinary mucus, possess little or no digestive properties.

[1] Loc. cit. p. 315.

[2] Purely gastric vomiting sometimes occurs, with copious ejection of "rice-water," in malignant cholera.—H.]

[3] For further details on this subject see Copland's Dictionary, art. "Rumination."

It is important, however, that it should be borne in mind that the presence of an excessive amount of free acid in the stomach is not in the majority of cases due to excessive secretion from its coats, but depends with great frequency on unnatural changes in the food; so that it is necessary at all times to distinguish *the acidity which results from fermentation* from *the acidity resulting from secretion.*

The former is due to all causes tending to delay or pervert the normal changes which the food undergoes in the digestive canal, and hence it is a common symptom of indigestion, however produced; it often also appears in its most intense forms when the natural secretions are diminished, or when their amounts do not present their normal relation to one another. Hence acidity from fermentation may arise (1) in all cases when digestion is delayed from imperfect supplies of the gastric juice; or (2) when the food is merely retained in the stomach by obstructions of the pyloric orifice; or (3) when food in a state of fermentation is introduced into the stomach in quantities sufficient to neutralize the antiseptic action of the gastric juice; or (4) when mucus possessing a catalytic action is secreted by the stomach; or (5) when, from disordered conditions of the salivary and buccal secretions, the proper changes are not effected during mastication in the amylaceous portions of the food; or (6) when in otherwise healthy subjects an excess of starchy or amylaceous substances is taken with the food. The results of this fermentative action are shown in the formation of acid products, usually derived from the starchy and saccharine elements. The acids so produced, and which are often formed with great rapidity, are chiefly the lactic, butyric, and acetic, which appear in great abundance under such circumstances: and further evidence of the fermentative character of the process is seen in the evolution of gas, which consists principally of carbonic acid and volatile carbo-hydrogens, while sulphuretted compounds appear when articles containing this element in excess have been taken with the food.[1]

[1] Frerichs, Rep. Clin. Lect. Med. Times and Gaz. 1841, ii. 410, divides the fermentative processes which may take place in the stomach into the following:—

(*a*) Alcoholic.
(*b*) Lactic.
(*c*) Butyric.

The lactic, which is a simple acid fermentation, causes no evolution of gas. The butyric succeeds the lactic, and is associated only with the formation of carbonic acid; but as butyric acid is volatile, it is perceptible in the eructations. Alcoholic fermentation may be attended by the formation of acetic acid

Flatulence and acidity are therefore almost constant results of imperfect digestion; but though produced by the same causes and therefore probably coexisting in the digestive tract, one only of them may in many cases be made apparent by eructation. Flatulence also may appear chiefly in the intestines, as the result of imperfect changes which the food has undergone in the mouth and stomach. Similar fermentative changes, evidenced by distension of the bowel and by frothy and pultaceous stools, may also result from defective metamorphosis of the food in the lower portions of the intestinal canal, arising from deficient supply or abnormal states of the secretions of the intestines, the liver,[1] and the pancreas, as well as from conditions impeding the absorption of the peptones.

With respect to alterations occurring in the secretions—

1. *An excessive secretion* from the glands of the stomach may affect either of the classes before alluded to, and may furnish fluids either of an acid or an alkaline character. The circumstances under which these different formations occur are not in all cases accurately known to us, but in some cases we are able to distinguish the cause of an arrest of the one and an excess of the other. Thus, under the influence of inflammatory action, or in many cases of excessive physiological stimulation, the acid gastric juice may be either completely arrested or is greatly diminished in amount,[2] while there is an undue formation of mucous secretions of an alkaline[3] reaction.

The most common causes of excessive secretions are, however, those of nervous origin, though the nature of the influences under which they thus originate are only imperfectly understood; and acid and alkaline secretions appear to be produced by different patients under circumstances in other respects apparently similar.

One form of disorder in which alkaline or neutral fluids are furnished in great quantities has received the distinctive name of *pyrosis*, from the burning sensation at the cardia which often precedes its ejection. It occurs endemically among the poorer classes of Scotland and of certain northern countries, and is, under these circumstances, attributed to the effects of an irritating or of an innutritious and insufficient diet. It is met with, however, occasionally, in the wealthier classes of both sexes, but particularly in nervous females, when there is no evidence of organic disease; and it also is an accompaniment of ulcer and cancer of the stomach.

The fluid thus ejected is clear, often insipid and neutral in reaction, and it is frequently brought up in considerable quantities by an act of regurgitation, sometimes without any effort at retching, though it may occasionally be expelled by vomiting. It has been considered by some authorities to consist merely of saliva which has been swallowed, an opinion which has received some support by the observation of Frerichs,[1] that it sometimes contains a considerable amount of sulpho-cyanide of potassium. It appears, however, to the author, that this admixture may be due either to some saliva swallowed or mingled with the fluid in the act of ejection. Patients also who are subject to the affection are by no means conscious of an amount of salivation at all proportionate to the quantity of fluid brought up from the stomach; and it would therefore appear more probable that the large proportion originates from an altered secretion of the fluids of the stomach.

Though the reaction of this fluid is very commonly neutral, yet occasionally highly acid fluids are ejected, under circumstances similar to the foregoing, and when, from their character and reaction, it is probable that they have been secreted by the stomach.[2] Some observations made by Dr. Pavy on these fluids tend to show that, while the acid fluids possess digestive properties, the neutral fluids have, even after acidulation, very little of this power.[3]

Acid fluids are also ejected under other circumstances of nervous derangement, chiefly of a reflex character, as in the vomiting of pregnancy, or from diseases of the uterus, or in that which takes place in attacks of renal and biliary colic. M. Chomel[4] has described another class, when, after attacks of cholera, vomiting of acid matters continued with great obstinacy, and in some instances proved fatal. The nature of these cases is, however, obscure. The fluids vomited do not

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and give rise to acid eructations. The conditions of fermentation are the delay of absorption and the presence of mucus in the stomach.

[1] Dogs in which a biliary fistula has been established pass a large amount of offensive flatus per annum.

[2] Bernard, Arch. Gen. Suppl. 1846, p. 7.

[3] Bidder and Schmidt, Verdauungs-saefte, p. 40; Frerichs, Wagner's Handwörterbuch der Physiologie, art. "Verdauung," p. 788; Blondlot, Traité Analytique de Digestion, p. 213; Beaumont's Exp. and Obs., Combes' Edition, p. 182; Corvisart (Longet's Physiologie, 1861, i. 184).

[1] Loc. cit. p. 791.

[2] For a case of this nature the reader is referred to the article on Cancer.

[3] Treatise on Digestion, p. 132.

[4] Des Dyspepsies, "Dyspepsie Acide Grave." These cases, according to M. Chomel, had a peculiar acid odor of the breath.

appear to have been chemically examined, and it may be considered doubtful whether the acidity observed was not derived from rapid fermentative action in the food, caused by the unhealthy condition of the stomach, rather than from any direct secretions from the mucous membrane.

2. *Perversion* of the secretions of the stomach is known to occur in the course of uræmia and diabetes. In the former case either urea[1] or carbonate of ammonia[2] is found in the secretions of the stomach. Bernard noticed that under these circumstances the secretion was still acid, and also that, instead of being evoked solely by the stimulus of food, it became more or less continuous,—a fact which may assist to explain much of the disturbance of the functions of the stomach which occurs in the course of this affection. In diabetes, sugar[3] is sometimes found in the secretions of the stomach; but we are not acquainted with any special effect which this admixture has upon the act of digestion.

It is not improbable that other alterations may occur in the composition of the gastric juice in certain blood diseases; but of the nature of these we are as yet ignorant. The possibility, also, of changes of a similar nature arising in the course of affections of the liver and pancreas is a subject rather of hypothesis than of direct proof.

3. *Arrest* or *diminution* of the secretion of gastric juice takes place under so many and varied conditions, that it is impossible to do more than briefly to summarize them here. They will be more fully treated of in relation to the special diseases of the stomach. Thus sudden moral or physical impressions, especially those of a depressing nature, exhausting mental and physical efforts, and many diseases of the nervous centres, have all this effect in common. Inflammatory processes, as already stated, produce the same results to an extent proportioned to the intensity of the process. Weakening diseases and physical exhaustion, and privation of food or water, similarly diminish the amount of the secretions of the stomach. Digestion also may be arrested, probably from reflex causes, through disordered conditions of the lower part of the intestinal canal,[4]—as from constipation, from the presence of worms in the intestines,[5] or even from enemata of cold water administered while digestion is proceeding; and the due appreciation of the influence of these and similar etiological circumstances is of the utmost importance in arriving at a correct understanding of many of the causes of an imperfect performance of the digestive act.

D. Digestion.—Imperfections in the due changes of the nitrogenized elements of the food by the gastric juices in the cavity of the stomach constitute the most important of the disorders in the functions of this organ.

To these defects the terms of indigestion, dyspepsia, or apepsia, have been applied.

In treating, however, of such aberrations as among the functional disorders of the stomach, several points require to be distinctly understood. In the first place, indigestion may result from derangements in the action of other parts of the gastro-intestinal canal, which contribute to the metamorphosis of the different constituents of alimentary matter. Disturbances in the digestive act may thus be caused by defects either in the quality or amount of the secretions derived from the buccal and salivary glands, and also from those of the pancreas, the liver, and of the intestines, affecting either the starchy, saccharine, or fatty elements of the food, and also of protein substances which have escaped the action of the stomach.

Secondly, similar derangements may depend not only on disorders primarily originating in these organs, but may result directly from the food supplied being either of a nature incapable of being affected by their secretions, or from its being presented to them in a form on which their action is with difficulty exerted.

Thirdly, it is also to be borne in mind, that the direct effects of this imperfect elaboration are such as are more or less common to the whole class of indigestions, and consist of certain fermentative or putrefactive changes in the food, to which allusion has already been made. There are however no certain and practical criteria by means of which under *ordinary* circumstances we can distinguish from the nature of these intrinsic *changes in the food* the special source of the derangement in which they have originated,[1] since the imperfect performance of any one of the functions of the digestion usually disturbs the actions of those next in physiological sequence, and often, though in a less but varying degree, reacts injuriously upon those which precede it in the order in which the food is presented.

[1] Lehmann, Phys. Chemie.
[2] Frerichs, die Brightsche-Nierenkrank, p. 97; Bernard, Liquides de l'Organisme, ii. 49.
[3] Bernard, Lec. Phys. Exp. i. 295, 300.
[4] Trousseau, Union Médicale, 1857.
[5] Beau, Dyspepsie Vermineuse.

[1] The author alludes to the more ordinary forms; the presence of the excess of fat, of the absence of bile in the feces, would, of course, respectively point to deficiency of the pancreatic or hepatic secretions, or of imperfect absorption by the lymphatics.

Fourthly, when we confine ourselves to indigestion as met with in the stomach, which is perhaps the most important organ in the series, we find that this disturbance may be produced by nearly every disorder to which the stomach is liable; and that the nature of the affections in which it originates cannot, as such, be discovered solely through imperfect changes in the food, but must be mainly determined by various concomitant circumstances, which may or may not be readily discoverable.

Hence when viewed as a whole the indigestion of food can only be regarded as a *symptom* revealed by a series of phenomena, some of which are the primary results of imperfect changes in the alimentary substances, while others are the more or less remote effects of these. The former, although varying within certain limits, according to the nature of the food, are common to all forms of indigestion however originating; but though of great importance as indicating the existence of this state, they are yet only secondary in diagnostic value to those symptoms through which the state of the stomach in which they primarily originate can be distinguished, and on the recognition of which any successful attempt at a pathological classification and consequent diagnosis must depend.[1] The distinction is not indeed always an easy one, since the acids and gases, produced by abnormal chemical processes in the food taken, almost constantly give rise to other secondary disturbances in all the chylopoietic viscera, which in some cases, and especially through the pain which they produce, are liable to be confounded with those originating in morbid states of these organs. Still, however, the separation of these classes is practically so important, that it is desirable as far as possible to maintain it, although it may be somewhat difficult to determine in which category any single symptom is to be placed when regarded apart from the whole group with which it is associated.

In such a mode of arrangement the symptoms arising directly from abnormal changes in the food,—such as acidity, flatulence, eructation, distension of the stomach and intestines with gas, borborygmi, and alterations in the fecal evacuations,—serve as evidences of fermentative processes, the nature, causes, and effects of which have been already discussed. Those, on the other hand, which may be regarded as more direct signs of disturbance of the stomach (though sometimes only resulting from the former) are weight, uneasiness, sinking, craving emptiness, or pain of different degrees of intensity, appearing either when the stomach is empty, or at variable periods, after the ingestion of food. With them also must be placed affections of the appetite and thirst, either on the side of excess, or deficiency, or perversion; and in the same category must be included symptoms arising in parts which are more remote, but yet forming part of the gastro-intestinal canal, such as the tongue, mouth, salivary glands, and fauces. Indigestion however may only be revealed by symptoms appearing in other organs, the connection of whose disorders with that of the stomach is a secondary nature, and which may be enumerated according to the parts in which they occur, viz.:—

Disturbances of the nervous system, indicated by neuralgic pains of the thoracic and abdominal muscles, weakness and weariness, or painful aching in the limbs; by headache, vertigo, perversions of vision, impaired intellectual activity, loss of memory, depression of spirits, anxiety, fear, morosity or irritability of temper; or by the various forms of hypochondriasis, melancholia, or hysteria; or, in some instances, by convulsive attacks.

Alterations in the urinary secretions, consisting sometimes of excess of watery fluids, or of urea; sometimes of diminution of the total amount, associated with lateritious sediments;—or of variations in its reaction, which sometimes shows an excessive acidity, and at other times is alkaline at the moment of emission, and containing in the latter case an undue amount of phosphates;—or in its contents, which may be abnormal, and exhibit albumen, sugar, cystine, or the salts of oxalic acid.

Disturbances in the generative organs, evidenced by perversions of the menstrual function, or by leucorrhœa, in the female;—or by impotence, priapism, or spermatorrhœa, in the male.

Alterations in the skin, manifested sometimes by febrile heat and suppression of perspiration; in other cases by general coldness and chilliness, especially of the extremities; or by perspiration on very slight exertion:—or by alterations in its

[1] Much of the difficulty and uncertainty in the treatment of dyspepsia has arisen from its being regarded as an individual disease, referred by one class of observers to atony (Cullen), by another to inflammatory conditions (Broussais), and by a third to disturbed innervation of the stomach (Barras). The confusion has been further increased by many writers, especially of the French school, introducing sub-varieties according to the prominence of individual symptoms, which, however, can never serve as a sound basis of classification. A further account of these opinions will be found in the Introduction to the author's work, "Diagnosis and Treatment of Dyspepsia." The most complete historical account of the views entertained respecting disorders of the stomach is that by Dr. T. J. Todd, art. "Indigestion," Cyc. Pract. Med. iii.

color or texture, which may be earthy or sallow in tint, or dry and coarse;—or by various eruptions, among the most frequent of which are erythema, eczema, herpes, acne, impetigo, lichen, or urticaria.

Alterations in the circulation, evidenced by frequent palpitation, occurring either spontaneously or on very slight exertion; by irregular action and intermission in the rhythm of the heart's contractions; and by weakness or excitability of pulse.

Alterations in the respiration, as shown by dyspnœa, occurring spontaneously, with a sense of load at the chest, or on slight exertion; or by cough, usually dry; or by asthmatic paroxysms.

Alterations in the general nutrition, as shown by anæmia; by emaciation, affecting all the tissues, but especially seen in certain parts, as in grayness or loss of the hair, caries of the teeth, retraction of the gums, and incurvation of the nails, which are thin and friable; or by excessive liability to inflammation, from slight causes, of the mucous membranes, and particularly of the conjunctivæ and throat. To which we may add, in persons predisposed to such affections, a liability to gout or rheumatism, or to renal or pulmonary affections, so that by very common consent pulmonary phthisis has been frequently regarded as a consequence of long-continued derangement of the digestion.[1]

These symptoms are very variously grouped, and sometimes occur with great irregularity; and it is important to note that those affecting the stomach may in some cases be far less prominent than others which, though occurring in distant parts, are still valuable evidence of the primary disturbance which exists in the functions of digestion.

And it must further be remarked, that many of them are not referable to the disorders of the stomach alone, but to perversions of the functions of the lower portion of the intestinal canal.

The secondary disturbances in the nervous system belong in an almost equal degree to derangements of the stomach and of the intestines; for as Beaumont has shown that vertigo was a common effect of irritation in the former, so, on the other hand, clinical experience is constantly demonstrating that this symptom is equally produced by flatulence and other derangements of the functions or condition of the latter. Many also of the moral and emotional disorders, and particularly depression of spirits, irritability of temper, and hypochondriasis, though sometimes undoubtedly originating from an independent and primary disorder of the nervous centres, appear often to result directly from the condition of constipation so frequently present; and though the origin of this is threefold, arising from imperfect changes in the food, diminished peristalsis of the muscular coats of the bowels, and from deficiency of secretion from the mucous membrane, the liver, and the pancreas, it is probably in a great measure to the last-named cause, which must materially affect the composition of the blood, that the nervous phenomena of this class are mainly attributable.[1]

It is therefore of importance for the cure of indigestion that the pathological condition in which it originates should be recognized, and also that the *causes* of such disorder should be discovered, and if possible removed. It therefore appears desirable briefly to summarize the chief of these, reserving a fuller description of their effects and mode of action for the chapters devoted to special disorders.

Causes of Indigestion.

As a healthy performance of the functions of the stomach depends on the harmony of the relations between the stomach and the food, our classification of the causes of indigestion may be conveniently divided into (1) those which depend on unsuitability of the food, and (2) those which affect the physiological functions of the organ.

1. *Dyspepsia from unsuitability of food*[2] may depend on defects in the quality or in the amount of the ingesta.

(*a*) Defects of quality may arise through aberrations in the proper proportions of the nutritive elements; among which may be enumerated excess or deficiency of any of the normal ingredients, saccharine, amylaceous, proteinous, or oleaginous, or some of the naturally indigestible materials which form a part of all human diet, and also excess or defect of sapid substances,[3] which, on the one hand, favor

[1] See especially Schmidtmann (Summ. Obs. Med. iii. 203), Wilson, Philip, and Dr. Hughes Bennett. This subject will be more fully dwelt upon hereafter.

[1] This subject has been fully treated of by Dr. Chambers, Lectures chiefly Clinical.

[2] The author is compelled, for the sake of brevity, to present this portion of his subject in a very condensed form. For a fuller explanation of this branch of the subject he would refer the reader to Paris on Diet, Brinton on Food, Parkes's Practical Hygiene, or to a summary of these subjects lately published by him, Diagnosis and Treatment of Dyspepsia, pp. 71 et seq.

[3] Under this head are included all condiments; which generally are of value in exciting the secretion of the saliva, and hence favoring the digestion of starchy foods. They have less influence on the secretions of the stomach (see Atonic Dyspepsia), but appear

the secretion of the digestive fluids, or may when in undue amount exert an injurious action on the tissues of the stomach.

(*b*) The food may be introduced into the stomach in an indigestible form through defects of cookery,[1] or through imperfect mastication and salivation,[2] or from its having undergone fermentation or putrefaction, or other changes which pervert or arrest the normal functions of the alimentary canal.[3] Alcohol in excess, or in too concentrated a form, retards the action of pepsine. Ice also, or large draughts of cold water, and diluents in excess, may diminish the secretion of the gastric juice by lowering the temperature of the stomach, or may impair its efficacy by undue dilution.

In the same category may be placed idiosyncrasies which certain persons exhibit against particular kinds of food[4] ordinarily reputed wholesome.

(*c*) Errors in the amount of food, particularly on the side of excess, are among the most common causes of indigestion.

The secretion of the gastric juice, at least in a healthy state, seems in some yet unexplained manner to be proportioned to the amount of material required for the repair of the waste of the system; and in the majority of cases, food introduced in excess of this, acts as a foreign body, and undergoes fermentative or putrefying chemical changes; or in the comparatively few instances where these do not ensue and the food is digested and assimilated, it gives rise to obesity and other evils, on which it would be beyond our province to dwell.[5]

Irregularity in, and especially too small intervals between, the periods of meals, involving the taking of food before the preceding supply has been digested and removed from the stomach, is another most frequent, and when indulged a necessary, source of indigestion. It is well known that the digestive powers of a given amount of the gastric secretion are limited, though the absorption of the peptones already formed, while the pepsine is retained in the stomach[1] by the dialytic action of the mucous membrane, greatly extends the duration of its action. It is nevertheless evident that, if as much food has been taken at one meal as the stomach can digest, the addition of a fresh supply before the former has passed from its cavity will only delay the changes which the whole has under such circumstances to undergo. Some of the food has been shown by Busch's observations[2] to pass rapidly into the duodenum; but a period of nearly five hours[3] must elapse before the whole of a full meal has passed through the pylorus; and in addition to this it is most important that a period of rest varying from one to two hours should be allowed to the organ. There are few medical men who are not acquainted with patients who allow a much shorter interval than this between each of the three principal meals of the day; and the effects of such a system are as injurious as, and practically are identical with, those of excessive eating; though it is often difficult to convince those who indulge in it of the error in their habits.[4] Many delicate people think that it is necessary to eat often to keep up their strength, but fail to recollect that when meals are taken frequently each should be small, and that when meat is eaten three times daily in tolerable quantities, the addition of milk, eggs, wine, and beef-tea, in the intervals, destroys the beneficial effects of all. It must be borne in mind also, in estimating the effects of a given diet on the health of a patient, that the amount required varies with the expenditure of the system, and that a sedentary life, whether habitual or suddenly entered upon, necessitates a reduction of the food taken, if health is to be maintained. The breach of this rule is often observed, and the ill effects produced on those who, having previously lived an active life, retain their customary habits of eating in periods of enforced or voluntary idleness, has long been well known. Indeed, in all dyspeptic derangements it is important for the practitioner to be on his guard against possible

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to be useful in some cases where digestive power is enfeebled by what may be relatively termed natural causes, as from old age, or from the effects of hot climates. It is probable, however, that agreeable impressions made upon the sense of taste favor the secretions of the gastric juice.

[1] Especially apparent in the amylaceous substances.

[2] The last named of these causes may arise solely from the former, or from disordered conditions of the salivary and buccal secretions which may either be defective, or, even when abundant, may be too watery or acid.

[3] Impure water, especially such as contains an excess of calcareous or magnesian salts, may be included in this category. See Parkes's Pract. Hygiene.

[4] Milk, eggs, cooked butter (Chomel, Dyspepsies, p. 8), mutton (Sir T. Watson, Princ. and Pract. of Physic, ii. 457), honey (Andral).

[5] See Dr. Parkes's excellent summary of these conditions in his treatise on Pract. Hygiene.

[1] See Kühne, Lehrbuch der Phys. Chemie, 39.

[2] Virchow's Archiv, xiv.

[3] Weber and Budge, loc. cit.; Kühne, loc. cit.

[4] See a case in point by Sir T. Watson, loc. cit. ii. 450.

errors in diet, and especially against those which, having become a question of habit, and of relative rather than absolute quantity of the food taken, are the more likely to elude both his own and his patient's observation. [Haste in eating, with imperfect mastication, is a common cause of indigestion in America.—H.]

Deficiency of food, though often mentioned among the causes of dyspepsia, and unfortunately holding among these but too prominent a place in the poorer classes of society, acts probably only in an indirect manner on the digestive powers by weakening those of the whole system. In these cases the food is also too frequently of innutritious quality, and the sloppy tea and bread which forms so large a proportion of the diet of many of our hospital patients is a constant source of the flatulent disturbances from which they suffer, and which, under the circumstances in which they are placed, are often very difficult to relieve. The effects of starvation, and the dangers of indiscriminately giving nourishment in such cases, are familiar to all readers of physiological works, and will be again referred to.

2. *Causes of indigestion referable to pathological states of the stomach* may be referred to abnormalities either in its secretions, or in its movements, or in the absorption of the peptones.

With disorders in the last-named of these functions we are only imperfectly acquainted,[1] but it is probable that under certain circumstances their unfavorable influence is by no means inconsiderable.

Causes affecting the secretion of the gastric juice are those which play the most important part in this category. They have been already in part alluded to, and may be briefly summarized in the following scheme :—

I. Causes tending to produce Deficiency.

A. *Organic.*
- (1) Inflammatory conditions, which reduce the amount of peptic fluids, but increase the mucus secreted.
- (2) Congestion.
- (3) Degeneration and atrophy of the secretory glands.
- (4) Pyrexial condition of the system.

B. *Inorganic.*
- (1) General weakness.
- (2) Disordered blood states.
- (3) Disorders of liver and pancreas (?).
- (4) Agencies operating through the nervous system—moral, intellectual, shock, exhaustion, invasion of acute diseases, narcotic remedies.

II. Causes tending to produce Excessive or Perverted Secretions.

(1) Ulcer and cancer.
(2) Inorganic agencies operating through the nervous system, chiefly sympathetic, and depending on irritation of other organs, as the mouth, fauces, intestinal canal, liver and gall-bladder, kidneys, and uterus.
(3) Disordered blood states.

Derangements in the movements of the stomach may injuriously affect digestion either by their deficiency, irregularity, or excess.

Deficiency of movement may result from weakened muscular power, from dilatation, and from paralytic conditions induced either through impaired innervation, or by inflammation of the peritoneal and possibly of the mucous coats.

Irregularity of contraction may result from obstructions of the pyloric orifice, from thickenings, indurations, malformations, or displacements of the stomach, or adhesions to adjacent viscera, or by simple pressure on the organ when distended with food, such as is exercised in certain trades, or by tight stays, or by diseases of the liver.

Excessive contraction induced by undue nervous excitability or by minor degrees of inflammation tend, independently of vomiting, to expel the food too rapidly from the stomach, and in the same category must be placed the effects of destruction by disease of the pyloric ring.

It will be seen from the foregoing that indigestion is in probably a considerable majority of cases the result of pathological conditions of the stomach which vary widely from one another in their essential nature and in their etiological relations. It is therefore impossible to form logical categories of classification founded on the derangements so produced in the functions of the stomach, since all of these—vomiting, pain, flatulence, acidity, &c.—may each in turn depend on many and totally different causes, some of which are organic and some purely functional in their nature. Nor can any convenient classification according to the causes of indigestion be adopted, since even in

[1] A case of affection of the lymphatics, in what appears to have been a simple ulcer of the stomach, is recorded by Andral, Clin. Méd. ii. 110.

those forms which arise from imperfections in the manner in which the food is presented, the result is frequently a complex one, and secondary effects of an inflammatory nature are often thus produced in the mucous membrane of the stomach which surpass in importance of intensity and duration the primary disorder of function. A classification therefore on a pathological, and as far as possible on an anatomical, basis, is the only one which can conduce to certainty of diagnosis, or to scientific principles of treatment.

The main lines of division which will be here adopted will be to distinguish the non-inflammatory dyspepsias from those which depend on inflammatory changes; the disorders produced by ulcer and cancer standing again in a distinct and separate category. In the first-named class will be included dyspepsias from simple weakness, whether general or local, and with these will be classed those forms resulting from atrophy, or from simple degeneration of the secretory glands, to all of which, collectively, the term of atonic dyspepsia will be applied.

Disorders in the functions of the stomach distinctly referable to impaired innervation will form a separate category, and the inflammatory varieties will be considered under the heads of the acute and chronic forms.

II. Atonic Dyspepsia.

Atonic Dyspepsia, which corresponds to the *Dyspepsie apyrétique* or *asthénique* of Broussais, may be defined as a disorder of the digestion, almost invariably chronic[1] in its course, unattended by fever, and rarely, when uncomplicated, by abdominal pain; whose existence is indicated by weight, uneasiness, and languor following the ingestion of food, together with a general depression of the vital powers; and whose causes are, in a great measure, identical with those which induce a general impairment of the nutrition and the powers of the whole body.

[1] Some writers, and especially the late Dr. J. Todd, Cyc. Pract. Med. iii. art. "Indigestion," describe an acute form of atonic indigestion, in which there is a sudden and total arrest of the digestion, attended with symptoms of irritation of the stomach. It may, indeed, be induced by sudden impressions made on the nervous system during the act of digestion; but unless under these circumstances the contents of the stomach are at once evacuated by vomiting, they prove a further source of irritation, and give rise to a condition of more or less inflammatory action, corresponding closely in character to the "Embarras Gastrique" of the French, and which will be more properly treated of among the "Inflammatory States of the Stomach."

Etiology.—Among the predisposing causes of atonic dyspepsia may be mentioned *hereditary disposition*, the evidence of which, though not resting on absolute numerical data, is so well attested by numerous observers, and, the author may mention, by many instances within his own knowledge, as to be, he believes, incontestable.

Age exercises an important influence also in determining this disorder, the diminution of the power of the stomach at advanced periods of life being, in many instances, as apparent as is that of the muscular or nervous systems — a fact which it is of great importance to recollect in the hygienic treatment of elderly people. Nor should the relatively limited digestive powers of the opposite extreme, in early infancy, be forgotten when, in spite of its great assimilative power, the capacity of the stomach for acting on other than a milk diet is extremely small. Aberrations in diet at this period are, however, more frequently the causes of acuter diseases of the gastro-intestinal canal than of simple failure in the metamorphosis of the food.

Impairment of the functions of the stomach may also be more directly produced by *states of the system* associated with more or less permanent conditions of *depressed vitality*, such as are sometimes observed from the effects of hot seasons and relaxing climates, unattended by any appreciable condition of disease. Still more commonly they are found to result from other causes acting either through the nutritive fluids, or the nervous system, singly or conjointly. In some cases alterations in the blood may be apparent, as in anæmia and chlorosis; but in others, even when nutrition evidently suffers, these are less evident. Similar effects on the digestion may be due to exhausting discharges, hemorrhages, leucorrhœa, profuse suppuration, cancer in other organs than the stomach, indulgence in venereal excesses, loss of sleep, sedentary occupations, especially such as are associated with deficiency of light and air, long-continued and depressing moral emotions, and the *ennui* of insufficient occupation, mental or physical.[1]

Simple loss of functional power is also produced by causes immediately affecting the stomach, such as excess of fluids taken at meals, especially when drunk warm, or by the abuse of narcotics, and of tea and coffee, by prolonged fasting,[2] by the undue

[1] One digests with the legs almost as much as with the stomach. (Chomel, loc. cit. p. 58.)

[2] The author has known severe and obstinate dyspepsia of the atonic kind induced by the habit of going without food from an early breakfast to a late dinner, and the cause ap-

use of condiments, which diminish the readiness with which the stomach is affected by its ordinary stimuli, by habitual constipation, and by undue mental or bodily exertion after meals.[1]

To these causes must also be added the indigestion which occurs in febrile states of the system, in which, as observed by Beaumont on Alexis St. Martin, "food taken in this condition of the stomach (see Pathology) remains undigested for twenty-four or forty-eight hours or more."[2]

It must, however, be remembered that the digestive power of the stomach apparently varies considerably in different individuals, and that a "weak digestion" does not necessarily mean a diseased state as long as persons with this peculiarity recognize the physiological laws of their nature. Health may be maintained by such individuals by regulating their food according to their digestive capacities. Such persons are, however, seldom able to bear with impunity efforts of mind or body equal to those which are sustained with safety by individuals of larger powers, inasmuch as their digestive power is commonly incapable of compensating for the increased waste. Exceptions, however, depending partly on variations of intellectual capacity or muscular or nervous power, are frequently noticed contradicting this proposition.

THE SYMPTOMS of this form of disorder are:—

(*a*) In the alimentary canal. A sense of weight or uneasiness in the stomach after food, occasioned by the slowness of the digestive process—symptoms which are often protracted for some hours after eating, and are frequently continued up to the next meal. This may afford temporary relief, but is in its turn followed by the same train of discomfort. The weight or uneasiness is in some cases felt behind the sternum, giving rise to a sense of dyspnœa, and at others to a feeling as if some foreign body were present in the œsophagus. It rarely, if ever, amounts to pain, though the condition in some patients, especially in anæmic, chlorotic, or hysterical women, may be accompanied by the complication of intercurrent neuralgia, and in others by an excessive amount of flatulence, giving rise to various degrees of gastrodynia or colic. Tenderness of the abdomen is as a rule entirely absent, and pressure not unfrequently gives relief to such pain as may be present, especially when this arises from flatulent distension.

The digestive powers are about equally impaired both for protein and amylaceous substances, but in many cases the former, when in any excess, aggravate this condition; and oily and fatty matters are very prone to disagree, as also do soups and broths.

Further disturbances appear in the form of flatulence and of eructation, both of gas and also of portions of undigested food, which are often rancid and offensive (probably from butyric acid fermentation). They usually occur some hours after eating—differing in this respect from the acidity following immediately after the ingestion of food which is observed in some cases of nervous origin. The flatulence affects the stomach and bowels in about equal degrees of frequency, sometimes appearing in one more than in the other; but the fermentative changes originating in the imperfect elaboration of the food in the stomach are usually continued in the lower portion of the canal, the functions of which are generally simultaneously impaired.

Impairment of the appetite, though not invariably observed, is a very common feature of all the more marked forms of this complaint. There is frequently a disrelish for food of all kinds, even when exhaustion is felt for want of it.[1]

Thirst is generally almost entirely absent, at least to any abnormal degree. In many cases there is a positive dislike for fluids, which not unfrequently (especially when taken with meals, or when nutriment is presented in a fluid form) are found to aggravate the dyspeptic symptoms.[2] The saliva is said in some cases to be increased (Todd); but this, as far as the author's observation extends, is not the rule in the state now being described.

The tongue is broad, pale, and flabby; pitted at the edges by the teeth; sometimes thinly furred; but becomes more thickly coated when irritation supervenes. The inner side of the lips and gums is pale, flabby, and sometimes spongy; the tonsils are occasionally enlarged, and the uvula and throat relaxed, giving to the voice a thickness and huskiness which the patient sometimes attempts to relieve by hawking and spitting. The breath is not

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pears explicable by the observations of Bidder and Schmidt, who found that the secretion of gastric juice was markedly diminished after long fasting. (Die Verdauungs-saefte, p. 41.)

[1] This is not unfrequently a cause of more acute attacks, and will be referred to hereafter.

[2] Experiments and Observations on the Gastric Juice, Combe's edition, p. 92.

[1] A very marked effect of long fasting is familiar to all under the title of having "overstayed the appetite."

[2] "Dyspepsie des Liquides" of Chomel. This fact is easily explicable when we recollect that undue dilution greatly impairs the efficiency of the gastric juice, and that in the condition under consideration that secretion is naturally defective in power.

unfrequently heavy and offensive, but not nearly to so marked a degree as in some of the irritative forms.

Constipation forms another prominent symptom; and though primarily resulting from the participation of the secretions and muscular actions of the intestinal canal in the general condition of atony, it aggravates the state of the stomach in the manner before described, and frequently increases the anorexia. The delay of the fecal matter in the intestines also favors the liberation of gas, which, distending the weakened muscular coat, tends still further to diminish its propulsive powers; hence various circumscribed swellings frequently appear in the abdomen, giving a mingled tympanitic and dull resonance on percussion, and borborygmi are heard when by pressure or the irregular contraction of the bowels the gas is moved from place to place. These distensions are particularly liable to occur in the course of the colon, especially at flexures in the right and left hypochondriac regions, where they not unfrequently cause a sense of fulness, tightness, pain, and dragging, which are often, though improperly, referred to the stomach, liver, or spleen. Pain from this cause is also occasionally felt in other parts, especially in the left side, at the insertion of the diaphragm into the ribs, or in the scapular regions.

The evacuations may be solid, dry, and hard, or scybalous, or frothy from fermentative action. They are usually paler than natural, and sometimes offensive; but unless an excess of animal food has been taken, this latter character is not so common as in some forms of inflammatory dyspepsia.

Diarrhœa when irritation supervenes may occasionally alternate with the constipation, but the latter is usually the most prominent symptom.

The circulation is depressed; the pulse is weak, soft, and easily compressible—slow when the patient is in repose, but easily excited on the slightest exertion. Palpitation is common; it occurs irregularly, and independently of organic disease of the heart, and is easily induced by slight exertion, but it frequently arises spontaneously without previous physical or mental effort. It is in many cases directly traceable to flatulent distension, though occasionally it occurs without any distinct evidence of this state. Intermission of the cardiac action, though not so common as palpitation, is also not unfrequent.[1]

[1] It may be noted here that a large number of patients who believe, from the symptoms here described, that they are suffering from disease of the heart, are only subject to this form of dyspeptic derangement.

Dyspnœa is a result not only of the cardiac state last described, but frequently occurs independently of it. The feeling is one of load or oppression in the upper part of the chest, and especially across the middle portion of the sternum, impelling the patient to sigh or to draw a deep breath, in order to relieve this sensation, which, however, speedily returns. Cough is occasionally caused by an elongated uvula, but the irritative cough frequently described as caused by disorders of the stomach is not usual in this form of dyspepsia.

Except in cases where indigestion is directly due to a febrile state, the course of this affection is singularly free from pyrexial symptoms; the skin is soft, flabby, clammy, and moist, and the extremities are frequently cold, particularly after meals. The complexion is often pallid, sallow, and muddy.

The nutrition suffers more by an aggravation of the anæmia or atony which may be present, than by any direct emaciation—a symptom which occurs more rapidly in the inflammatory and irritative forms.

The urine, as a rule, is but little affected; it is usually clear and copious, and contains but little urea, unless some direct causes of enfeeblement of the constitution, producing excessive waste, are present. Under the latter circumstances the urea may be greatly in excess of the normal amount. If irritation supervenes, other changes may occur in this fluid, which will be again alluded to when these conditions are described.

The nervous system indicates in many ways not only its affection by the general state of the system, but also by the special conditions of indigestion. Languor and inaptitude for exertion, and a sense of weariness in the limbs, which are most evident after meals, are often the earliest, and sometimes during a long period the only symptoms of the disturbed functions of digestion. They sometimes pass into an almost unconquerable drowsiness after food, which, when yielded to, affords a heavy but unrefreshing sleep. There is frequently an impairment of the intellectual faculties,[1] which, though more marked during the period of digestion, also continues at other times, and chiefly affects the memory and attention; the temper also is apathetic and timid.

[The dyspeptic is usually much occupied with his own symptoms. All the conditions of hypochondriasis are thus sometimes presented.—H.]

The duration of this condition is very indefinite, depending as it does in a great measure on the persistence of the causes

[1] Sir J. Clark lays great stress on this diminution of the intellectual powers Climate, ed. 1830, p. 257).

in which it has its origin. If these be removed, and a healthier state of general nutrition be restored, the stomach may, in some cases, easily regain its tone and functions, but in other instances a marked diminution of the digestive powers may persist long after the original cause of disturbance has been removed.[1]

Sometimes the combination of weakened nutrition and diminished functional power conduces directly to further changes, excited by the irritant action of the undigested food on the mucous membrane, and giving rise to phenomena of a more or less inflammatory character. These not only greatly aggravate the original symptoms, but tend materially to prolong the duration of the disorder; the progress of which is frequently varied by acute exacerbations attributable to this cause, and which, it is important to remark, may also be brought into operation by medicinal stimulants administered without sufficient caution.

PATHOLOGY.—The form of disorder of the digestion now under consideration rarely depends on conditions by which the stomach alone is affected. It is with so much greater frequency associated with general states of the system characterized by the terms ATONY or ASTHENIA, that its pathology, in the majority of instances, only forms a part of that of the constitutional states signified by these names, which, if not in all cases capable of precise logical definition, have nevertheless a tolerably distinct meaning. At present they are generally understood to signify a simple impairment of the functional powers of an organ or tissue unattended by appreciable anatomical alterations. In relation to these, however, it requires also to be stated, that as healthy function presupposes and absolutely requires for its performance a healthy condition of nutrition and innervation, so in most of the cases distinguished by simple diminution of power, but unattended by other marked derangements of function, both the nutrition in a molecular sense and also the chemical constitution of the tissues are more or less impaired or perverted. In many instances, however, the nature of these finer alterations is at present unknown; and if in some cases the defect in the vital action is referred to disturbances in innervation, we are only carried back a step further to an inquiry of the same character, concerning the condition of the nervous structures, and where the same as yet unsolved problem confronts us.

[1] See a remarkable case of this kind recorded by Andral, of dyspepsia originating in the habit of masturbation (Clin. Méd. ii. 193).

MORBID ANATOMY.—Though in a certain number of cases of atony or asthenia the inference of mal-nutrition underlying this state is rather a matter of induction than of positive proof, there is yet a large class where it appears to depend directly on apppreciable anatomical alterations of the nature of atrophy or degeneration, the vital phenomena exhibited by which are frequently clinically undistinguishable from those of the former order to which we have alluded.

In this class may therefore be first mentioned those forms of simple atrophy of the mucous membrane of the stomach, associated with marked thinness and transparency of its walls, which have been mentioned by earlier, and even by some modern, writers, with very little reference to their clinical significance, but which, as has been shown by the researches of Dr. H. Jones,[1] Dr. Habershon,[2] Rokitansky,[3] Dr. Fenwick,[4] and the author,[5] are often combined with fatty degeneration and wasting of its tubular structures. These have been found in many instances to have been replaced by a greater or less amount of fibro-nucleated tissue, and this change has been observed by Drs. Handfield Jones, Habershon, and the author,[6] to be in many cases associated with distinct loss of power in the digestive functions during life; while Dr. Fenwick has proved that in such cases the digestive powers of the mucous membrane after death are also markedly diminished.[7]

[1] Path. Soc. Trans. iv. and v. 1853–4. Med.-Chir. Trans. 1864. Diseases of Stomach, 1855.

[2] Guy's Hosp. Rep. 3d Ser. ii. 1855. Observations on Alimentary Canal, 1857.

[3] Pathologische Anatomie.

[4] Morbid Changes in Stomach and Intestinal Villi in Persons dying of Cancer: Med.-Chir. Trans. 1865.

[5] Contributions to the Pathology of the Glandular Structures of the Stomach; Med.-Chir. Trans. 1858. Diagnosis and Treatment of Varieties of Dyspepsia, 1867.

[6] In a former paper of purely pathological investigation into the subject before quoted, I stated that I had not then had the opportunity of tracing the clinical histories of the patients whose stomachs I had examined. Since that period I have, however, been able to trace in several instances the concurrence of anorexia and loss of digestive power with these conditions of degeneration. Dr. Fenwick has recently published a case—Lancet, 1870, ii. 78—where atrophy of the glands was general throughout the whole of the mucous membrane of the stomach; and where the patient, a gentleman ætat. 45, died with gradually increasing exhaustion. Vomiting also occurred. Dr. Fenwick found the digestive power of the mucous membrane markedly diminished.

[7] In Dr. Fenwick's cases the stomachs so

Both Drs. H. Jones and Fenwick have shown that these conditions may occur independently of inflammatory action. The author's researches have, however, convinced him that such degenerations are produced with great frequency in the stomach, as in other organs, through the destructive effects of this process upon its tissues, and that therefore in many instances simple atony may be regarded as the result of a pre-existent inflammation, though not necessarily indicating its continuance as a cause of the state—a proposition which affords pathological evidence and support to clinical observations on diseases of the stomach, where irritative action has often been known to be followed by long-continued asthenia.

In several of Dr. H. Jones's cases the changes in question were met with at advanced periods of life, and probably belonged to the category of senile degenerations. Dr. Fenwick has also pointed out that in the cases in which he observed these alterations in the stomach analogous degenerations had occurred in other tissues, and especially in those of the vascular system.[1]

Closely allied to these conditions of degeneration are those where the digestive power is weakened and sometimes almost completely abolished inflammatory or febrile conditions of the system, and of which Beaumont's observations on Alexis St. Martin gave very distinct evidence.[2] Histological investigation also reveals in the stomach changes similar to those discoverable under these circumstances in other glandular organs, as well as in the heart and voluntary muscles. The epithelial cells are granular and disintegrate easily, evincing a tendency to a retrograde metamorphosis, or defective nutritive by which their functions are impaired or diminished. The condition is, indeed, one which it is not always easy to distinguish from the earlier or minor degrees of recent inflammatory change; but there can be very little doubt that molecular softening and granular disintegration may occur independently of this process. Tissues thus weakened in their nutrition are, however, liable to undergo, from the slightest causes, acuter destructive processes associated with vascular disturbance, to which the author believes that the name of "Inflammation" may still, in the present state of our knowledge, be applied; and therefore, while some of the forms of the so-called dyspepsia febrilis belong to simple atony from arrested nutrition, another and a very large class, to which allusion will be made hereafter, require to be classed under those having an inflammatory origin.[1]

DIAGNOSIS.—The difficulty in the diagnosis of all varieties of dyspepsia depends on the fact before alluded to, that the symptoms arising from imperfect changes in the food are common to all conditions in which these may originate. The discrimination of the form now under consideration depends chiefly on the absence of the evidences of organic affection and of severe nervous derangement, coupled with the etiological circumstances of its origin. It is essentially a chronic affection, and therefore is mainly to be distinguished from chronic catarrhal inflammation. The leading characteristics of atonic dyspepsia in contradistinction to those of chronic catarrh are—(1) The minor degree of gastric uneasiness, and the absence of epigastric tenderness; (2) the simple deficiency of appetite, and the absence of thirst; (3) the absence of pyrexia; and (4) the condition of the tongue, which exhibits no signs of irritative action of the gastro-intestinal tract[2] (see Chronic Catarrh, p. 894), but is pale, broad, and flabby. The constitutional symptoms are

altered showed scarcely any traces of self-digestion, and the mucous membrane, after the addition of hydrochloric acid, when digested with 10 grains of albumen, dissolved only $\frac{6}{10}$ of a grain, whereas 11 grains of albumen digested similarly with a healthy stomach lost four grains.

[1] Dr. Fenwick's observations were chiefly made upon patients dying of cancerous disease of the breast. As catarrhal conditions of the stomach are very common in cancerous disease, even when this organ is not affected by the growth (see Lebert, Traité des Malad. Canc. 115), the degenerations found by this author may possibly have been the result of past inflammatory conditions.

[2] See also Bernard's confirmation of this evidence, Arch. Gén., Suppl. 1846, pp. 8 and 204.

[1] Beaumont's description is so graphic, and possesses the so infinitely great advantage of being drawn from life, instead of from more dubious post-mortem changes, that it appears well that it should be again quoted *in extenso*, especially as it affords convincing proof that the two distinct conditions of the stomach may exist under these circumstances; the one irritative, the other atonic:—

"In febrile diathesis, or predisposition from whatever cause, ... the villous coat becomes sometimes red and dry, at other times pale and moist, and loses its smooth and healthy appearance; the secretions become vitiated, greatly diminished, or entirely suppressed; the mucous coat scarcely perceptible, the follicles flat and flaccid, with secretions insufficient to protect the vascular and nervous papillæ from irritation."—Loc. cit. p. 98.

[2] For a further discussion of the value of these indications the author would again refer to a previous work, "Diagnosis and Treatment of Dyspepsia," p. 16 et seq.

also less severe, and the course of the affection is more uniform.

The diagnosis from cases of ulcer and cancer is easily made when in these affections pain, vomiting, and hæmatemesis are present. In the earlier stages of cancer the symptoms may closely simulate those of simple atony, in loss of appetite and of digestive power, and sometimes it is impossible to obtain absolute certainty in diagnosis. The conditions which would attract suspicion of the more serious disease are failure of appetite, loss of strength, anæmia or other signs of cachexia commencing without manifest cause in a person who has passed the age of forty. Pain, when not traceable to intestinal colic, should always excite suspicion of a more serious disorder than simple functional dyspepsia.

The Prognosis of atonic dyspepsia varies with its etiology. Cases where the disorder is of purely functional origin, and where it has been induced by causes acting directly on the stomach, are usually amenable to treatment. When, however, the defective digestion is only a part of a more general condition of the system, the restoration of the powers of the stomach must depend on the possibility of improving the health of the patient, and of removing the conditions which have induced the disease.

Cases also where there is any suspicion of degenerative changes in the glands, as in obstinate atonic senile dyspepsia, or where symptoms of indigestion persist after long-continued inflammatory or catarrhal conditions of the mucous membranes, have necessarily a much more unfavorable aspect than those where the state is one of mere functional activity.

When connected with or arising from anæmia, the result of organic disease in other organs, atonic dyspepsia, though seldom immediately fatal, not unfrequently proves a most serious complication of the original disorder, tending, with a rapidity proportioned to its severity, to further impair the strength and the general nutrition of the patient. When uncomplicated it rarely appears to act directly as a cause of secondary diseases, but it seldom continues long without passing into some of the irritative forms, and the effect of these is not only to maintain, but also to aggravate, the original condition of defective digestive power. The injury which it causes to the general nutrition may however predispose to disease in other organs, as the lungs, brain, heart, or kidneys, according to the several liabilities of each of these as a *locus minoris resistentiæ* to other injurious influences which may come into operation; but I confess that I am indisposed to entertain the opinion that simple functional impairment of the powers of the stomach has any tendency directly to induce the more serious organic diseases of this viscus, such as ulcer and cancer.[1]

The Treatment of this form of dyspepsia is comprehended under the title of Tonic, and implies the use of all such agencies as are capable of increasing functional power by restoring the conditions of healthy nutrition; indications which are to be fulfilled by measures adopted—

1. To improve the quality of the blood, and to regulate its transmission, by means of suitable diet, by medicinal agents capable of altering its composition, when this is defective, and by re-establishing the digestive and nervous powers.

2. To enable the system to appropriate and act upon the nutriment conveyed to the tissues, through methods calculated to favor healthy metamorphosis and the elimination of effete products. Our object is thus simultaneously to increase the vigor of the system and also of the stomach; since it must be remembered that, while the due performance of the functions of the latter is essential to the nutrition of the body, yet that, on the other hand, a permanent increase in the powers of any single part cannot take place without a healthy condition of the whole system.

The treatment directed to these objects may be conveniently divided into regiminal and dietetic, and medicinal.

(*a*) Regiminal and dietetic.

As regards diet, the primary necessity is to administer the most easily assimilable food, and at the same time to avoid overloading the stomach, and thus aggravating the existing weakness, or exciting inflammatory irritation.

In cases of great impairment of the digestive powers arising from pyrexial conditions, hemorrhages, long privation, or exhausting discharges, food must be given in very small quantities at short intervals. Milk and strong beef-tea, and animal jellies, combined with alcoholic stimulants, are the forms that should be selected for this purpose.[2]

For the less severe but more frequent forms that are met with in the dyspepsias of the sedentary, or of those subjected to mental strain or anxiety, the main outlines of diet only can be sketched in this place. Three moderate meals daily are usually sufficient, but a fourth may occa-

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[1] This opinion has been expressed by M. Beau.

[2] The methods recently proposed by Dr. Marcet ("On a New Method of preparing Meat for Weak Stomachs") and by Dr. Pavy (loc. cit.), of subjecting animal food to artificial digestion before its administration, may prove to be beneficial in these cases.

sionally be permitted on retiring to rest. A cup of tea may, however, often be taken with advantage before rising in the morning. The food chosen should be varied, but selected for its digestibility.

Fresh cooked meat should be eaten at least twice daily. Beef and mutton, and game, with the exception of hares and rabbits, are to be preferred. Chicken, calves' feet, sweetbread, and tripe may also be permitted; but pork and veal, and salted or preserved meats, should be excluded. Eggs, when they agree, are to be recommended.

Fish is less desirable, but may be eaten with moderation. Oysters often are found to agree well; but differences in this respect are observed in individual cases.

Vegetables should by no means be excluded; but caution is requisite in their use. When they cause much flatulence, their place may be supplied by rice or maccaroni, and by some fruits, especially by grapes, strawberries, and stewed prunes. [Peaches, in good condition, agree with most dyspeptics; apples with many. Cherries, watermelons, and cantaloupes are unsuitable for them.—H.] Potatoes should always be well boiled, and not eaten too young. Other vegetables should also be fresh and carefully boiled. Turnips, parsnips, Jerusalem artichokes, onions, and the Cruciferæ often disagree; but spinach, vegetable marrow, beetroot, young peas, and French beans may commonly be taken.

Bread should not be eaten new. Aërated bread often agrees better than the ordinary forms. Biscuits or toast are often, however, preferable. Fresh butter may also be eaten in moderation.

Pastry is to be eschewed; but light farinaceous puddings generally agree well. Fried dishes should be forbidden, and in the same category must be placed the Crustacea, and nuts, pickles, and cheese.

Much fluid at meals should be avoided. Cocoa made from the nibs, or milk and water, may be taken when tea and coffee disagree. A moderate quantity of wine should however be taken twice daily.[1] The selection may commonly be left to the patient, unless under special circumstances. Sherry, claret, hock, and champagne generally suit the best. Malt liquors are only to be used with caution, as they often cause flatulence.

Sugar[2] may be used in moderation; but other condiments are to be avoided, except in the case of elderly people, or of those habituated to their use, since they have been shown to possess very little power of increasing the amount of gastric juice, and are liable to cause irritation.

The *general regimen* must also be tonic, including under this head sufficient rest[1] both at night and also after meals; the avoidance of hot, ill-ventilated apartments, both in the day and at night; and the spending as much time as possible, consistently with the avoidance of undue fatigue, in the open air. Travelling, especially in open carriages, yachting, or sea-voyages, frequently prove highly beneficial in cases marked by much weakness, while for those of less severity horse exercise is as a rule more advantageous than walking. Exercise, especially in the open air, pushed to a degree short of producing exhaustion, has probably a greater influence in increasing the digestive powers of the stomach than any other single measure: hence for those who of necessity lead sedentary lives in large cities the use of gymnasia often proves of great service, by bringing into play a larger proportion of the muscular system than is exerted in mere walking. It must, however, be remembered that exhaustion is to be most carefully avoided, and that after any active exercise a sufficient amount of time should be allowed to elapse to allow the body to cool and the nervous system to repose before food is taken.[2]

The influence of the intellectual and moral functions on the digestive powers is so marked that it cannot escape notice in this place; and it should always be recommended to patients harassed by care or anxiety, as well as to those engaged in absorbing intellectual pursuits, to take their meals in cheerful society. In many such cases, however, a complete cure is unattainable, except by a change of thought and scene.

The effects of cold bathing will, as a rule, be beneficial or not according to the powers of reaction of the patient. It is decidedly injurious when this is not speedy, and complete and lasting, and even in some of the latter class the exhaustion following the bath more than compensates for the temporary pleasure derived from its use. A healthy state of the skin being, however, a great object, a

[1] Bernard, Lec. Phys. Exp. ii. 420, has shown that diluted alcohol is one of the most effective stimulants to the secretion of the gastric juice. [Many observations, however, have shown that concentrated alcohol interferes with the normal action of pepsin.—H.]

[2] Independently of its value as an article of diet, sugar has been shown to be an effective stimulant of the secretion of the gastric juice (Blondlot, p. 223).

[1] The importance of perfect rest is shown by a case of Andral's (Clin. Méd. ii. 191), when a condition of atony supervening upon irritative dyspepsia was only finally cured by retaining the patient for more than two months in bed.

[2] If exhaustion is felt after exercise, it is often advantageous to take a small quantity of an alcoholic stimulant a short time before the food.

tepid bath taken daily, together with the use of the hair glove or flesh-brush, should be strongly recommended. A residence even temporarily in a dry and bracing climate is frequently of the highest value. The air of Brighton often proves of great service when there is no irritability of the mucous membrane; and next in order may be placed Scarborough, Dover, Folkestone, Margate, Eastbourne, Malvern, Tunbridge Wells, and the Surrey Downs; Ilfracombe, on the western coast, also possesses many advantages. A high situation, on a porous soil, is that which in general is best suited to patients of this class.

As a prelude to all discussion of the effects of medical treatment for this disorder, it is not unimportant to state that, although often proving of great value as adjuvants of the general hygienic measures which have now been indicated, the employment of drugs independently of these is of comparatively little service. Even under any circumstances, no little caution is necessary in the selection, doses, and mode of administration of medicinal agents, in order to avoid the causation under their influence of irritative conditions, which are peculiarly liable to supervene in tissues whose vitality and power of resisting external impressions is already below the healthy standard.

The objects to be fulfilled by therapeutic measures may be conveniently summarized under the following heads:—

(1) Tonics to permanently increase the powers of the organ and of the system generally.

(2) Stimulants or stomachics to increase the secretory powers of the stomach, and which, by thus accelerating the digestive process, act indirectly as tonics, by favoring the assimilation of nutritive materials.

(3) Adjuvants to supply materials in which the gastric juice may be presumed to be defective.

(4) Certain remedies for special symptoms or conditions, which may not only hinder the digestive process, but may interfere with the comfort of the patient.

When anæmia is present the use of iron is strongly indicated; but its action is less marked in cases of functional debility unattended by this state. The carbonate, the potassio-tartrate, the ammonio-citrate, or the ferrum redactum usually suit the best; but when there is much relaxation of the tissues the tincture of the perchloride or the sulphate may be used. The former may be given before meals, the two latter should be taken immediately after food. If these preparations disagree, the lactate or the syrup of the pyrophosphate may be sometimes resorted to with advantage. [I have known the syrup of the iodide to answer very well.—H.] Parrish's acid syrup of iron and lime often agrees well with children, to whom also the vinum ferri is well suited. When constipation is a marked symptom, and also in females whose menstruation is scanty or infrequent, iron may often be combined with advantage with one or two grains of the watery extract of aloes.

In other instances the natural mineral waters of Tunbridge Wells, of Spa in Belgium, or of Homburg, Kissingen, or Schwalbach, prove of greater efficiency than any pharmaceutical preparations; and their beneficial effects are probably much assisted by the advantage resulting from the change of scene and of the mode of living, which those experience who visit these places from distant parts.

It should be mentioned as a caution, that in conditions of gastric irritability iron is usually tolerated with difficulty; and that some preliminary treatment is often necessary before, even in atonic dyspepsia, its administration is attended with advantage. It may often be advantageously combined with mild aperients, of which the aloetic class are generally the best, and particularly in the case of chlorotic females.

Much caution is requisite in resorting to the vegetable bitters, many of which, though increasing the appetite, appear to have little or no influence in augmenting the digestive powers,[1] and, further, have frequently a considerable tendency to cause irritation of the stomach. Their effect as tonics, in any general sense of the term, appears also to be of a very questionable nature.

Two remedies of this class have, however, a more distinct general, and a more persistent local effect, and therefore appear to deserve a place among the true tonics, viz., nux vomica, or its alkaloid strychnia, and quinine. The former of these often proves a most valuable tonic remedy, improving apparently the nervous energy of the stomach, as well as that of the system at large. Thus in many cases, by increasing the muscular contractility of the stomach and intestines, it aids (in addition to the antiseptic effects common to all bitters, but largely possessed by strychnia) in preventing the distension by flatus, which is so common and distressing a symptom in the cases now under consideration.

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[1] See on this subject Buchheim's "Arzeneimittellehre," p. 42; Shrenk, "De Vi et Effectû quorundam Medicaminum in Digestionem;" Diss. Inaug., Dorpat. 1849; Clarus, "Arzeneimittellehre," p. 1014. These authors have remarked that the increase of the appetite is only due to local irritation—an effect which, as Griesinger, Arch. Phys. Heilk. vi. 399, has shown, results equally from small doses of many of the more irritant metallic poisons.

The most convenient mode of administering it is in the form of the tincture, in doses of from five to ten drops with infusion of orange-peel and syrup; and it may be advantageously combined with the mineral acids, in cases which appear to require the administration of these remedies. Its use in many of the painful neuroses will be further alluded to when they are treated of.

Quinine is a more doubtful remedy in stomach affections, though at times it undoubtedly does good service. Its tendency to cause headache, and nausea and irritation of the stomach, requires caution where any signs of the latter condition exist. Still, in cases of convalescence from severe diseases, when the tongue is clean, but pale, broad, and flabby, and there is little tendency to constipation or to congestive headache, and also in persons of lymphatic constitution with relaxed conditions of the system, it also proves of value. It may be given in pill or powder, in doses of one or two grains, taken daily before or with meals, or in the form of the Tinct. Cinchonæ Composita, or Battley's Liquor Cinchonæ, both of which preparations often appear to agree better than the pure alkaloid. In other cases, where iron is simultaneously indicated, the Ferri et Quinæ Citras may be resorted to.[1]

The other remedies of the class of bitters appear to rank rather among the stimulants and stomachics than with the tonics as above described. They may therefore be conveniently subdivided into four sub-classes, viz., simple bitters, aromatic bitters, aromatics, and stimulants[2] to the gastric secretion of a more general character.

The simple and aromatic bitters have the greatest influence in increasing the appetite, and when this is defective their administration is especially indicated, but with the caution that loss of appetite is not always to be relied on as a diagnostic symptom of atonic dyspepsia, but is common in many inflammatory diseases of the stomach, when the use of these remedies is prejudicial. The effects of many of these are familiar enough to the profession, and also to the public, especially in the use of infusion of quassia before meals; and chiretta appears to have a very similar action.[1]

Judging from the researches of Corvisart, it would appear that the aromatic bitters, in addition to their powers of increasing appetite, have a greater influence in promoting gastric secretion than those last named; and among the principal remedies of this nature may be enumerated absinthe, hop, chamomile, cascarilla, and calumba.

Of these, calumba holds the chief place in point of therapeutic value, as a remedy which can be safely employed when others of the class would be too irritating.[2] It may be used as an infusion or tincture, and the former may often be advantageously administered in conjunction with other aromatics, or with acids, alkalies, or ferruginous preparations; but when a more active effect of the same character is required, other remedies of this class may be resorted to with benefit. [An excellent pill is one which was much used by the elder Dr. W. Pepper; composed of equal parts of rhubarb and extract of gentian.—H.]

As regards the more direct stimulants, their administration is indicated before or with food. The effects of a moderate quantity of wine in aiding a weak digestion have been already alluded to; and

[1] Quinine more frequently disagrees when given in solution in conjunction with sulphuric acid: a combination rarely indicated, but which, as it appears to me, is too frequently employed.

[2] It is important in relation to this subject that the varied effects of different agents on the gastric secretions should be constantly remembered. Blondlot (Traité Analytique), Bernard (Arch. Gén. 1846), Corvisart (Longet's Physiologie, 1861, p. 184), have shown that the most active agents of this nature are alkalies (and in this respect the effects of the alkaline saliva must be remembered), cold water, diluted alcohol, ether, sugar, absinthe, chicory, ipecacuanha, nitrate of bismuth, and diluted solutions of common salt. To these Corvisart adds black coffee, the effects of which must appear, however, somewhat doubtful to those who are acquainted with the almost total arrest of digestion which sometimes follows its use. Its effect, however, appears to be of an opposite character in different classes of patients, suiting well the lymphatic temperament, but injurious to persons of nervous excitability. See Trousseau et Pidoux, Traité de Thérap. ii. 533. Stronger stimulants, such as cathartics (Blondlot, loc. cit. p. 213; Beaumont, loc. cit. p. 182), powdered salt (Bardeleben and Frerichs, loc. cit. art. "Verdauung," p. 788), condiments (Beaumont and Buchheim and Engel), and even mechanical irritants, as charcoal (Corvisart), produce a large amount of mucous secretion, either alkaline or feebly acid, but possessing but small digestive powers.

[1] Of gentian it should be observed, that though possessing the advantages of a laxative in addition to those of a bitter, its characters as an irritant are more marked, and that additional caution is therefore requisite in its use.

[2] Calumba appears to possess some direct "sedative" properties; thus it is sometimes useful in the vomiting of pregnancy and in sea-sickness, and even in minor degrees of subacute inflammatory action, and it has been known to check the vomiting caused by tartar emetic (Pereira).

bitter beer, combining the aromatic and bitter qualities of the hop, often proves of service in milder cases, where flatulence is not one of the symptoms complained of. Where, however, there is a tendency to fermentation of the food, malt liquors are distinctly contraindicated.

Another remedy of the same class, ipecacuanha, originally prescribed by Daubenton, has of late been brought into more common use, by the advocacy of Dr. Budd. It should be given in pills, in doses of half a grain to one grain before meals, and may often be combined with advantage with three or four grains of rhubarb.

Other combinations of the same kind occasionally prove useful, such as chamomile[1] together with rhubarb and ginger. Cayenne pepper is sometimes employed in the same manner, but its use is less advisable. The value of alkalies when taken during meals, in the form of Vichy water, liquor potassæ, or the carbonates of potash and soda in combination together with wine or malt liquors, is probably in some degree attributable to their physiological effects on the secretions of the gastric juice. They have also been employed for the same object by my friend Dr. George Harley, in small doses, properly diluted, before meals, with good effects in promoting digestion.[2]

As *adjuvants* to the process of digestion two series of agents deserve especial mention, viz., the mineral acids and pepsine.

The efficacy of the former of these has been long known. Their use is not, however, limited to cases of simple atony, but they sometimes prove serviceable in many cases of irritative dyspepsia when from inflammatory causes the secretion of gastric juice is defective, and to which fuller reference will hereafter be made.

Of these acids the hydrochloric stands undoubtedly the first in point of utility,—a fact which is easily comprehensible from its being probably the most active agent in the normal process of digestion. It should be taken, in doses of from fifteen to twenty drops of the dilute acid of the British Pharmacopœia, suitably diluted with water, immediately before, or during, or directly after a meal. It may be rendered more palatable by the addition of syrupus aurantii; and may often be very advantageously combined with some of the bitter remedies before mentioned, especially with the tincture of nux vomica, the liquor cinchonæ, or the infusion of calumba. Employed in this manner it will often, in the less severe cases, be found to relieve the sense of weight and distension ensuing after food. It frequently also prevents the acidity and flatulence arising from the fermentation which results from the imperfect action of the gastric juice, though it must be considered problematical whether in these doses it has the intrinsic power of checking this process which Liebig[1] attributes to the stronger mineral acids, and to which Pemberton[2] ascribed their influence on the relief of flatulence.

The phosphoric and nitric acids have been recommended for the same purposes by other writers (Todd, Pemberton), but their influence in aiding digestion is much less marked than that of the hydrochloric, while nitric acid not unfrequently produces irritating effects on the stomach, and may give rise to pain or nausea.

Dr. Handfield Jones[3] has for similar purposes found the use of lactic acid, as recommended by Majendie,[4] to be productive of good results; he administers it in doses of fifteen to twenty drops, suitably diluted, at meal times, and in some cases of irritative dyspepsia, he considers it decidedly preferable to the hydrochloric.[5]

Though the efficacy of pepsine has occasionally been called in question by some recent writers, my own experience would induce me to bear a strong testimony in its favor—not only in the form of dyspepsia now under consideration, but also in some conditions when the digestive process is impaired by irritative states of the mucous membrane. It may often be very advantageously taken simultaneously with hydrochloric acid at meal times.[6]

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[1] Chamomile has the advantage of possessing slightly laxative properties, and is said by Trousseau (Traité de Thérap.) to be very beneficial in the atonic and flatulent forms of gouty dyspepsia.

[2] The effect, as Blondlot and Bernard have shown, of the administration of a small amount of diluted alkali on an empty stomach is to cause a secretion of gastric juice, much greater than is sufficient to neutralize the alkali.

[1] Animal Chemistry, p. 386.

[2] Diseases of the abdominal viscera, p. 122.

[3] Functional Nervous Disorders, p. 420.

[4] Formulaire pour la Préparation et l'Emploi de plusieurs nouveaux Médicaments. 1835.

[5] Hünefeld's experiments under Budge, "De Albuminis Succo Gastrico factitio Solubilitate," showed that hydrochloric acid gave the greatest digestive powers, lactic acid less, and acetic acid the least (Canstatt, 1859. i. 30). Trousseau's clinical experience of the relative value of the mineral acids indicates a decided superiority on the part of hydrochloric (Clin. Méd. ii. 377). Meissner also has found that, in artificial digestion, it is necessary to use ten times more lactic than hydrochloric acid to produce a digestive mixture of the same strength (Henle and Pfeuffer's Zeitsch. 3d Ser. vol. vii. p. 16).

[6] *Ingluvin*, from the gizzards of fowls, is asserted by some to have a similar good effect.—H.]

The complications of atonic dyspepsia which must call for medical relief are constipation, flatulence, and acidity.

In remedying constipation, much care is required to avoid irritation, and only the gentlest and least irritating laxatives are desirable. When possible, even these should be dispensed with, and the action of the bowels when not occurring, should be daily solicited by the use of enemata of cold water.

Friction, or the wet compress worn at night, protected by a piece of mackintosh, or the use of the cold douche to the abdomen, are often useful adjuvants in this respect.

When medicines are used, rhubarb and aloes are to be preferred to all others. Either may be given with food, a method which diminishes to some degree the danger of irritation resulting from their use, and they frequently may, with advantage, be combined with small doses, as a quarter of a grain, of the extract of nux vomica.

Recourse should however be had as little as possible to purgative remedies, for it may become difficult afterwards to shake off the habit of requiring their aid, and the use of strong aperients tends still further to exhaust the muscular and nervous powers of the intestines. In many cases of atonic dyspepsia, when there is any considerable degree of general debility, there is very little occasion for a *daily* action from the bowels, but care should at the same time be exercised to obviate any undue accumulation of feces in the intestine.

When acidity and flatulent spasm exist together with the constipation, antacids, and especially the magnesia usta, or magnesiæ carbonas, in combination with tinct. rhei and aromatics, may be employed with advantage for the same objects. In severer cases, especially in the gouty flatulence of elderly people or of females at the climacteric period, assafœtida, either in combination with aloes or in the form of the compound galbanum pill, is frequently of considerable service. If the flatus exists in the stomach, large draughts of warm water may sometimes prove efficacious in promoting its expulsion, by eructation; while tympanitic distension of the bowels may be relieved by enemata containing turpentine, assafœtida, oleum rutæ, or sometimes by infusion of chamomile.

Other remedies for flatulence may at times be employed, though they only act as very temporary palliatives, such as the more cordial aromatics, the spiritus ammoniæ aromaticus, the aqua anethi, or peppermint water. In some cases the absorbent powers of charcoal are of service, though to possess any efficacy of this kind it is necessary that it should be recently prepared.[1]

It must be remarked that no single plan of medicinal treatment should be too continuously protracted, and that a change of remedies within the limits of those above indicated is often productive of good effects. Many that seem at first beneficial appear after a time to lose their efficacy, and may be advantageously replaced by others of a different class according to the predominance of individual symptoms; and even the ferruginous preparation, on which so much stress has been laid, should not be persisted in without intermission.[2]

The period during which bitter remedies prove efficacious is equally limited. Preparations of nux vomica or calumba are tolerated longer than most of the others, but the prolonged administration of the former may entail nervous accidents and dangers of over-excitability of the spinal cord, which may sometimes persist to an unsafe degree after the discontinuance of the drug; and even when its use is beneficial it should seldom be persisted in longer than a month or six weeks. If the favorable effects of bitter remedies do not become apparent after a few days, it is better to discontinue them; and under all circumstances it is necessary to watch closely for signs of gastric irritation, since if these are present they are generally aggravated by this class of remedies.

[Among the habits promotive of Dyspepsia amongst business men in the United States, is that of making the interval too long between breakfast and dinner; or taking, in place of the latter meal, a hurried and insufficient lunch, in the midst of the pressure of the day's occupations. I have known aggravated dyspepsia to disappear almost immediately upon the patient leaving his place of business for an hour every day, and taking a good hot dinner; of course very simple at first, but sufficient for nourishment.

With working men and women, I have known the habit of taking strong coffee freely three times a day to cause dyspepsia; cured by leaving it off.—H.]

[1] Belloc, who first introduced it, recommended that it should be made from the young shoots of the poplar, and stated that, given in doses of from 30 grains to 3 drachms in the twenty-four hours, it acted slightly as a laxative. Dr. Leared has of late praised the efficacy of the charcoal made from vegetable ivory for this purpose.

[2] Sydenham (Op. Omnia, Syd. Soc. Ed. p. 347) recommended their employment in hysterical or ataxic cases for a period of thirty days, and it is seldom that they can be taken with advantage for a longer period, though they may be resumed after an interval of ten days or a fortnight.

III. Neuroses of the Stomach.

Synonyms.—*Erethism of Stomach* (Barras and Trousseau), *Gastralgia* (Barras, Valleix), *Morbid Sensibility of Stomach?* (Whytt, Johnson).

Definition.—An unnatural excitability of the stomach characterized by either extreme degrees of perversion of its functions, or by an excessive exaltation of its sensibility. Its principal symptoms consist of *pain*, *vomiting*, *perversions of its secretions*, and commonly of the *appetite*. These are frequently, but not constantly, associated with an impairment of the *digestive powers*, but are unattended by any appreciable anatomical change, and they usually occur under conditions capable of producing reflex irritation, or of inducing asthenic constitutional states associated with extreme nervous excitability.

The immediate mechanism of the production of such conditions appear to depend in some cases on nervous disturbance, which may be designated as primary, but in other instances they originate from the disorders of other, and sometimes of distant parts, by which the functions of the stomach are affected in the manner just described as reflex.

Etiology.—The predisposing causes of disturbances of the functions of the stomach resulting from perverted innervation, while embracing many of those general conditions which have been before enumerated as capable of inducing the atonic state, further include the special causes which are capable, in addition to weakness, of giving rise to extreme nervous excitability. We thus find that they are predominant in the female sex,[1] and occur with much less frequency among men. They are, however, rare before puberty,[2] and they are less common at advanced periods of life, than between the ages of fifteen and forty. A special proclivity at two different ages is, however, in the female sex determined by sexual conditions, the epochs of the appearance and cessation of the menstrual function being in them peculiarly liable to be marked by these disturbances; while in the male sex the only extraneous influences determined through ages are such as result from the increasing anxieties and severer intellectual efforts which are often called for in those between thirty and fifty.

Hereditary disposition is by some writers mentioned among their predisposing causes, and there seems no reason to doubt its occasional possible influence in this direction.

Of the special determining causes, *exhaustion* plays the most prominent part, and when combined with other depressing influences, and particularly with those of a moral character and operating through the nervous system, such as grief, fear, anxiety, or severe intellectual effort, it is an almost unfailing source of perversion of the functions of the stomach, which can only be referred to disturbed innervation. These, however, may originate under almost any circumstances of impaired vitality or of diminished constitutional power, whether apparently spontaneous, as in the states of anæmia and chlorosis (which though most common in the female sex have been observed to be thus associated in men), or which may be produced by hemorrhage,[1] or by privation of food, by venereal excesses, and particularly by the habit of masturbation.[2]

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[1] Georget, art. "Gastralgie," Dict. de Méd. x. 81, says that these nervous disorders are ten times more frequent in the female than in the male sex.

[2] With the exception of cases of vomiting from cerebral disease, and the rarer instances of simple uncomplicated reflex disturbance of the stomach arising during dentition, the periods of infancy and childhood are comparatively free from the severer forms of gastric disorder of a nervous character. The immunity thus enjoyed in the earlier ages of life is probably, in part at least, due to the absence of those profounder impressions made by moral emotions, which, as will be presently mentioned, serve in a great number of instances as their determining causes. Some cases are, however, recorded by Dr. Handfield Jones (Functional Nervous Disorders, pp. 412 et seq.), where neurotic abdominal pain was observed in boys before and at the period of puberty (see especially one by Dr. Martin, of Rochester, Brit. Med. Journ. July 16, 1859). In some, however, of these cases the pain appears to have been seated in the abdominal muscles rather than in the stomach.

[1] Thus, Whytt (Works, p. 568) mentions a case of a young man who was bled largely for a pain in the side, arising from a fall from a horse. After some days he was attacked by a sense of intense cold in the stomach, and this was followed by intense pain recurring in a paroxysmal form two or three times in the twenty-four hours. The attacks continued for some weeks, but he gradually recovered under the use of "stomachics;" but having on another occasion experienced a similar, though smaller, loss of blood, the attacks of pain returned, but in a less severe degree. See also a case where pain and acid vomiting occurred after attacks of hemorrhage from piles (Budd, p. 198). Hæmorrhoids in hysterical women are capable of producing extreme reflex disturbance of the stomach. In a case lately under my observation these ceased after the removal of the immediate exciting cause.

[2] Georget, Dict. de Méd. x. 84. Andral, Clin. Méd. ii. 193. Schmidtmann, "De Car-

Diseased states of the nervous centres may also act as causes of these perversions.[1] The chief facts which are known with respect to these relations have been already alluded to, and they do not thus far appear to require further description in this place.

By far the most frequent, however, of all the causes assignable as the starting-point of these disturbances, are the complex states expressed under the terms *Hysteria* and *Hypochondriasis*.[2] Their frequency in hysteria may be estimated by the statement of Briquet,[3] that of 358 cases of this affection, only 30 had no sign of "gastralgia," or "epigastralgia;" 130 had only pain at the epigastric region; while 187 had both pain and derangements of the digestive function: and this author states that the latter are among the first symptoms in females in whom hysteria is slowly developed.

Among other causes operating probably on the general or local nervous centres through changes in the composition of blood, may be mentioned malarial conditions, which may impart to neuroses of the stomach a specifically intermitting character.[1] From the present state of our knowledge of the pathology of gout, it would almost follow that this affection should be placed in the same category, though the dyspeptic disturbances occurring in patients of this class may be referable to widely different causes, among which inflammatory conditions probably play no inconsiderable part.

With them also may be included, but with a certain degree of reservation, the effects of long-continued alcoholic poisoning, which, as Dr. Budd[2] remarks, greatly resemble those produced by exhaustion.

Of the immediate exciting causes, sudden emotions, especially of a depressing kind, are among those most frequently cited as having given rise to these disorders; but a similar effect may be produced by moral affections of the same character acting through a longer period.[3] The influence exerted by painful emotions not only in arresting digestion, but in producing painful sensations in the epigastric region, is well known, and these effects are greatly heightened in the case of patients whose nervous susceptibility is more than usually prominent.

As special conditions, acting locally, may be mentioned the abuse of stimulants and condiments, and in particular the habit of taking large quantities of tea and coffee.[4]

Finally, in some cases the effects of idiosyncrasy must be considered. Some of these have been already alluded to, and reference may be made to two cases by Andral,[5] in one of which the use of milk always caused violent pain, while in another honey invariably gave rise to vomiting.

The causes capable of acting on the stomach by reflex irritation, conducted

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dialgia," Summ. Obs. Med. vol. iii. p. 191, says: "Raro infantes puerosque invadit, crebrius juvenes et juvencas, atque eos in primis quando fœdæ deleteriæque sese addixere masturbationi: inde cardialgia in juvenibus obvia mihi semper suspicionem movet eos masturbari, atque disquisitione institutâ rarenter à vero aberravi." Ibid. iii. 205.

[1] Both gastric pain and vomiting may be excited by cerebral hemorrhage, so as even to give rise to suspicions of poisoning. A case of this kind came within the author's own experience (recorded in Bennett's Clin. Med. 1865, p. 405). A similar one is quoted by Henoch from Krukenberg (Unterleibs-Krank. ii. 205). Empis, De la Granulie, p. 150, has recorded a case where epigastric pain and vomiting occurred in tubercular meningitis.

[2] The frequency with which the perversions of the moral and intellectual functions which are included under this title are found associated with all forms of dyspepsia may very properly give rise to the question, how far in all cases it can be regarded as standing to them in the relation of a cause, or whether in an almost equal number it is not either a direct consequence of the derangements of the digestion, or whether both these and the hypochondriasis are not together the expressions of a more general nervous disorder. There is, however, little doubt that, in whatever manner originating, the peculiar mental state accompanying this condition serves in no small measure to intensify the gastric disturbance already existing, through the exclusive direction of the mind to the sensations experienced in the stomach, the influence of which, as pointed out by Dr. Carpenter, in describing the effects of "expectant attention" on the organic functions, is by no means inconsiderable.

[3] Traité de l'Hysterie, p. 251.

[1] Niemeyer, loc. cit. p. 546.

[2] This is hardly, however, to be spoken of as a simple state, inasmuch as these cases are usually complicated by catarrh of the stomach, attributable, probably, to the immediate effects of the alcohol on the mucous membrane.

[3] See cases by Barras, Briquet, Andral.

[4] The latter agent is very commonly admitted to be an exceedingly frequent cause of gastrodynia, and of dyspepsia associated with much nervous disturbance. See Clarus, "Arzeneimittellehre," p. 666; also Wood, "Therapeutics and Pharmacology," i. 628. I have seen it stated, though I cannot find the original, that girls employed in needlework, and in the Manchester factories, have not unfrequently a habit of chewing tea, with results evidencing a greatly disturbed condition of innervation both of the general system and of the stomach. The habit does not, however, appear common in London.

[5] Pathologie Interne, i. 153.

from other parts, have also been dwelt upon in previous sections, and it is only necessary therefore briefly to recapitulate them in this place.

They are, as has been seen, very numerous, and include sympathies with parts whose apparent connection with the stomach is very obscure, and some of which can only act, in all probability, through the general influence which *pain* exerts both on the appetite and on the digestive functions. Such are diseases of the external ear and of the teeth ;[1] painful affections of the kidneys, testicles, and ovaries ; disordered conditions of the lower portions of the alimentary canal, among which may be enumerated piles, worms, constipation, herniæ, including the omental and epiploic ; diseases of the pancreas[2] and of the liver, and especially gall-stones and abscess of the latter organ ; and with a frequency far exceeding that of all those just enumerated must be mentioned diseases of the uterus, including tumors, polypi, ulcerations, prolapsus, retro- and anteversions, and yet more commonly disturbances of menstruation, leucorrhœa, and the state of pregnancy. With the exception of the last-named state—which is, however, far more frequently associated with disorders of the stomach in weakly than in strong and healthy patients—there are few of the uterine derangements here enumerated which are not more or less associated with an impairment of the general nutrition. The majority also appear to be more truly connected either as cause or effect with the primary disorder, than to arise through the disordered digestion, which is frequently the last in the series ; while, with respect to frequency, though not perhaps to severity, leucorrhœa and disordered menstruation hold the foremost rank among this class of etiological conditions.

Symptoms.—The class of symptoms by which nervous affections of the stomach are especially characterized have been already alluded to as consisting chiefly of pain, vomiting, and certain forms of hyper-secretion. These may, however, occur in every possible variety of combination with each other, and with other symptoms of indigestion, as well as in very varying degrees of severity. No special relationship can, as a rule, be traced between any of them and the different etiological circumstances just described under which they may occur; and causes apparently identical may, in different subjects, give rise to dissimilar symptoms ; while, on the other hand, the most diverse perversions of function may occasionally be met with in cases whose mode of origin is to all appearances perfectly alike. Certain peculiar features do, however, mark some of the forms assumed by them, in connection either with particular states of the system or with special causes of nervous irritation ; and in the description about to follow, the disorders that occur in the course of hysteria, chlorosis, amenorrhœa, hypochondriasis, exhaustion, gout, and certain uterine disturbances, will be more specially considered ; those originating from other reflex conditions, or from organic diseases of the cerebral centres, being comparatively so rare and exceptional, that though their mode of causation is occasionally of diagnostic importance, they can hardly be included in a categorical description of the symptoms of the more usual forms.

The modes of invasion of these symptoms of nervous "erethism" may be either gradual or sudden, standing in this respect in an almost direct relationship to conditions similar in point of time or intensity of the exciting cause.

In the class of hysterical cases, *loss or depravation of appetite* is sometimes an early symptom, proceeding in many cases either to an absolute anorexia, which may even involve the nutrition of the patient in considerable danger ;[1] or to some of the extraordinary perversions known under the names of Pica or Boulimia.[2] Sometimes the last-named symptom becomes predominant, and the patients are affected with a ravenous and almost insatiable desire for food, compelling them to eat at all hours of the day and night, and the origin of which in perverted sensation is evidenced by the feelings of sickness, pain, and faintness which ensue if the gratification of this desire is withheld.[3]

[1] See a case by Liederer of a young lady in whom a false tooth fixed to the socket of a diseased one caused regularly returning attacks of pain and vomiting, which ceased immediately on removal of the pressure from the dental nerve. Allg. Weiner Med. Zeit. No. 24, 1861.

[2] Claessen, quoted by Bamberger.

[1] Briquet, p. 254.

[2] Pica, Citta, Malakia Pseudorexia, are terms signifying a perverted appetite, in which desires are experienced for unnatural kinds of food—coal, chalk, pins, or even loathsome substances. Boulimia is applied to an excessive desire for food. Copland's Dict. of Med., art. "Appetite." Landre Beauvais, Dict. Sciences Méd. iii. art. "Boulimia."

[3] I have seen this state in a most intense form in an elderly single lady of between 70 and 80 years of age, who certainly has never exhibited any signs of hysteria. Every cause depressing her health is followed by a return of the symptom. The hunger distresses her chiefly at night, when she is obliged to eat several platesful of sandwiches. No other disease is present. She suffers from indigestion, but not so much when the hunger is

"The psychical relations of the sense of hunger are altered; there is no appetite, and taking food affords no enjoyment."

Severer symptoms, however, often speedily ensue, and among the most prominent of these is *pain*, which, however, varies greatly in duration and intensity. Commencing ordinarily with a sense or constriction or oppression, or sometimes with a feeling of distension or weight, it is followed by sensations of an agonizing character, which are variously described by the patients as consisting of heat, cold, tearing, gnawing, rending, or twisting. In the severer attacks the heart's action is interfered with, becoming fluttering and irregular; the extremities are cold, and there is a tendency to syncope; in some cases convulsions are said to have ensued from the severity of the pain (Schmidtmann). Pain of this nature, though often aggravated by slight pressure upon the abdominal muscles ("épigastralgie" of Briquet), is usually relieved when it is made more firmly and persistently; and this is especially true of those forms that are associated with cramp or flatulence, but the conditions observed in this respect are somewhat uncertain.

The pain is sometimes associated with distension of the abdomen; at others this is sunk and retracted (Romberg). It is essentially paroxysmal in its character, returning sometimes at irregular, in other cases at regular periods on successive days in cases where the attacks are not attributable to malarious influences. In other cases, it returns only at the menstrual periods, and there is comparative immunity in the intervals.[1]

The duration of the attacks is variable. They may last only for a few minutes, or may continue for hours. They frequently terminate in gaseous eructation, or with the ejection of a watery fluid, which may be acid, or alkaline (pyrosis), or of mucus of an alkaline character, and of variable degrees of tenacity; and they are commonly followed by a sense of soreness at the epigastrium, and by great exhaustion.

The relation of the effects of the ingestion of food to the pain is subject to some variations. There is one distinct class, before alluded to, where this gives distinct relief;[1] and these cases form not only the larger number, but are those in which there is least suspicion of the accuracy of the diagnosis. This effect is certainly that most commonly met with in cases where the gastrodynia is associated with depressed vitality arising from exhaustion, or with nervous irritability dependent on moral or emotional causes. Another remarkable feature in these cases is, that insipid food and demulcents often cause much more pain than substances which are not only less digestible, but are even irritating in their character; and this peculiarity, which has been observed by numerous writers,[2] is not without value in diagnosis. In other and rarer instances, which especially occur in aggravated forms of hysteria, and in some where the pain in the stomach is of reflex origin, and more particularly where it is due to uterine disturbance, the ingestion of food is immediately followed by severe pain, which is only relieved by vomiting; and though in some cases the appetite may be preserved, the fear of the agony caused

present. She has been temporarily relieved by bromide of potassium, nitrate of silver, strychnia, and arsenic. The latter procured the longest period of immunity; but the symptom repeatedly returns whenever any impairment of health takes place. The condition, though generally occurring in the female sex, may sometimes be met with in males, as is shown by an extremely marked case recorded by Chomel, Des Dyspepsies, p. 94.

[1] Romberg, loc. cit. p. 107. Romberg remarks that this hyperæsthesia rarely occurs in an isolated or idiopathic form, and that it is found in a variety of morbid states—sometimes appearing as reflex or sympathetic, sometimes associated with other hyperæsthesiæ—and is observed during convalescence from severe diseases, in hysteria, helminthiasis, ergotism, or as the precursor of other diseases, and especially of gout.

[2] Barras gives two cases where gastrodynia was associated with suppression of the menses: in one of these the pain was less violent when the discharge became more abundant. In this latter case there was also flatulence, and the pain was relieved by food. (Loc. cit. i. 587.) Niemeyer, loc. cit. p. 545, also gives a case of this character, where the pain only occurred at the menstrual period, but in which the application of leeches to the cervix uteri instantly caused its return. It must be remembered, however, that an increase in the severity of the pain at the period of menstruation has been observed in some cases of gastric ulcer.

[1] See Budd, loc. cit. pp. 282, 283.

[2] "An uncommon delicacy of the nerves of the stomach, which may be either in a great measure natural or brought on by disease, ... excessive grief, or other causes, is to be distinguished from that . . . increased sensibility, which is the consequence of an inflammation, or of an aphthous state of those parts, since in these last cases every acid substance gives them pain, whereas in the former many insipid and seemingly innocent substances produce great uneasiness in the stomach and bowels, while volatile spirits, strong wines, brandy, and spiceries, are not only inoffensive, but often necessary for allaying those disorders which are produced in the first passages by such causes as would scarcely produce any disturbance in the second state."—Whytt, loc. cit. p. 544. See also the same author, loc. cit. p. 566; see also Barras, loc. cit. i. 35, 414, 440.

by the food entering the stomach prevents the patient from eating.[1] In other instances, pain of this character is only felt some hours after food; but here the conditions are more complex, and pyrosis or great distension of the stomach from flatus is often present; in which latter case, though much of the pain felt may be due to the spasmodic contraction of its coats, some is also, in all probability, to be attributed to the cramp-like action of the abdominal muscles.

The state of the digestion sometimes affords a valuable criterion of the nervous origin of these affections; in many cases it is entirely unaffected in the intervals of the attacks,[2] while in others the ordinary symptoms of atonic dyspepsia are present. The tongue is, as a rule, clean, though often pale, broad, and flabby:[3] the bowels are generally confined, but the feces are not otherwise altered. In cases, however, to be hereafter alluded to, when nervous excitability coexists with various degrees of inflammatory irritation of the stomach, these signs are lost. One remarkable feature with regard to these attacks is, that where any predisposition to them is present they may be brought on by painful moral emotions.[4]

Vomiting, though often attending the paroxysmal attacks last described, may also occur as an independent condition, unaccompanied by pain. This, though common in cases where it originates in reflex disturbances, or in certain disorders of the central nervous system, may also be observed in states characterized by simple perversion of function, and especially in hysteria. Its isolated appearance in the latter class, independently of other disturbances of sensation, is, however, the exception rather than the rule, though in some instances such pain belongs more to the class which Briquet has termed "épigastralgie," than truly referable to the stomach.[5]

Nausea usually precedes to some degree the expulsory act; but its duration and intensity are shorter and less marked than in the vomiting which attends inflammatory or organic diseases of the stomach—approximating in this respect to the conditions observed in the vomiting from cerebral causes.

In some cases intervals of several hours, or even days, may elapse between the recurrences of this symptom, and during them the digestion may be good, or there may be (as in pregnancy) some degree of acidity, apparently from hypersecretion, after each meal; but in others, and apparently in proportion to the severity of the exciting cause, and also in pregnancy and hysteria, the vomiting tends to become continuous. Under such circumstances the food is rejected either as soon as taken, or within a few hours after eating, being often returned completely undigested, and rarely associated with bile or mucus (Briquet). Even when vomiting is severe, the appetite may in some hysterical cases continue, and may even present an apparent increase of intensity, so that the patient's time may be passed in alternate vomiting and eating;[1] but in other instances, when the disorder has commenced after moral depression, and when pain is also present, there may be a more or less absolute anorexia.[2]

In many cases of hysterical vomiting it has been a matter of repeated observation that the general nutrition and strength remain but little affected; but when the vomiting is severe and constant, emaciation may rapidly ensue from the loss of food thus occasioned. The occasional dangerous effects of this symptom in pregnancy are well known, and have been already alluded to; and others of a similar character are detailed by Andral[3] and Budd,[4] where, although vomiting had continued long, the stomach was found healthy after death. In some of the cases of the latter class, though fever was absent in their earlier periods (thus conforming to the rule generally observed), it appeared, associated with delirium, towards their close, and in some instances assumed a distinctly hectic character.

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[1] Briquet, p. 256. These cases are, however, those in which the accuracy of the diagnosis from ulcer must often be held in doubt, even when made by the most competent observer.

[2] This can only be said to be relatively true in regard to the diagnosis of these affections from those of an inflammatory nature. The same fact is often observed in the progress of cancer, and sometimes of ulcer, when associated with epigastric pain.

[3] The varieties of appearances of the tongue described by Dr. Todd, loc. cit. p. 632, as indicating this state, viz., "a thin white gauze," "a milky appearance," or "a covering of frothy mucus," belong, I believe, to catarrhal conditions.

[4] Whytt, loc. cit. p. 560.

[5] See a case related by Briquet, loc. cit. p. 218, of a girl who, after severe moral emotion, was brought to the hospital with violent pain at the epigastrium, together with vomiting, which excited the suspicion of poisoning. The pain was relieved in ten minutes by faradization.

[1] Briquet, loc. cit. p. 255.

[2] Andral, loc. cit.

[3] Clin. Méd. ii. 175–179.

[4] Loc. cit. p. 261. With regard to Andral's cases, however, the conclusions drawn from the apparently healthy state of the stomach should be received, in the author's opinion, with some caution, on the grounds stated in the chapter on the post-mortem appearances presented by the stomach.

The effects of varieties of food in promoting or retarding the occurrence of vomiting are almost as variable as are their relations to the symptom of pain. In the severer forms just alluded to, solids and meat have been known to increase both the pain and the vomiting (Budd); but when hysterical symptoms are well marked, indigestible and apparently unsuitable food may be tolerated when ordinary aliments are rejected as soon as taken.[1]

There is another form of dyspepsia occurring under nervous influences, of which I have seen some examples, but which, as far as I am aware, has been fully described only by M. Trousseau.[2] It occurs both in males and females, under conditions usually preceded by some cause of exhaustion, especially affecting the nervous system; and my friend and colleague, Dr. Ringer, informs me that he has also observed it in children, and I have also met with it under five years of age. It is attended with an excessive appetite (boulimia), and by a sense of want following too speedily after food has been taken. The characteristic symptom is, however, that diarrhœa is present, and the evacuations, which are usually preceded by borborygmi and colicky pains, are induced with great facility by slight causes of an emotional character, and they contain considerable quantities of food which have passed undigested through the intestinal canal. Frequently an evacuation occurs immediately on rising in the morning, and is followed by a great sense of exhaustion; and I have observed in some cases that this can be delayed until the usual hour after breakfast, by simply taking a small quantity of food before rising. Trousseau ascribes these symptoms to an undue irritability of the muscular coat of the stomach and intestines, hurrying the food taken too rapidly through the whole canal, without permitting time for its due elaboration; and the influence of appropriate treatment strongly corroborates his opinion.

[1] See a case by Barras, loc. cit. i. 496, where the first food retained was a salad made with hard-boiled eggs. A precisely similar one is recorded by Briquet, loc. cit. p. 307; another by Guipon, loc. cit. p. 349, when the acid vomiting of pregnancy was immediately arrested by the use of *beer*. Valleix, Bull. Thérap. Oct. 1849, has noticed that meat and champagne were retained when milk was rejected, and that a kind of food which was retained one day was vomited on the next, and *vice versa*.

[2] Clin. Médicale, ed. 1862, pp. 354, 365, 428, 429. This is probably also allied to the affection alluded to by Abercrombie, "Diseases of Stomach and Intestines," 3d edition, p. 71, and by Whytt, loc. cit. p. 530, as *quick digestion*.

The affections of the general system frequently associated with the conditions which have now been described are nearly all such as point to their relation to a common cause. Many of them belong to the category of neuralgias, which occur either in distant or in proximate parts, and their appearance often alternates with remissions in the gastric disturbances. These often affect the dorsal, thoracic, abdominal, and intercostal muscles; but they may assume the forms of toothache,[1] hemicrania, lumbago,[2] or sciatica.[3] Instead of pain, other symptoms of nervous excitability may be present, such as attacks of cardiac palpitation[4], or of strong pulsations of the abdominal aorta,[5] which often occur both during and in the intervals between the attacks of abdominal pain, and are distinguished by their sudden invasion and cessation, and by their rapid exacerbations. Dyspnœa,[6] globus, hiccough, paralytic,[7] syncopal,[8] or convulsive affections, salivation, and a copious discharge of pale urine[9] have all been observed, with greater or less frequency, as concomitants of these affections of the stomach, and indicate very clearly the condition of perverted innervation from which its disorders arise, and which can be traced to the states of chlorosis, hysteria, melancholia,[10] or hypochondriasis, in which they take their origin.

The sleep also is affected in the majority of cases, and particularly in hysterical patients, who not only experience a difficulty in going to sleep, but are liable to awake during the night, with a great sense of exhaustion and hunger. Insomnolence is also commonly observed in patients of both sexes in whom disorder of the stomach has been caused by anxiety or overfatigue, though in them the feeling of

[1] Common in pregnancy.

[2] See a case of lumbago alternating with gastrodynia, Andral, Clin. Méd. ii. 297.

[3] Abercrombie, loc. cit. p. 86. Barras (i. 440) gives a case where a patient who had been subject to periodical headache became attacked with intermitting gastrodynia accompanied by the vomiting of mucus, but not of food, and which ceased on the supervention of sciatica. Two or three such attacks, with a similar order of sequence, were repeated at considerable intervals.

[4] This, however, is a symptom common to all forms of dyspepsia.

[5] Barras, loc. cit. p. 411. Walshe, Dis. of Heart, 3d ed. 438. Lebert, Virchow's Handbuch, V. ii. 53.

[6] Whytt, loc. cit. p. 560.

[7] A very interesting case of this nature, by Dr. Perceval, is to be found in the Med.-Chir. Trans. iv. p. 17.

[8] Guipon, loc. cit. p. 118.

[9] For a case of this kind occurring in a *male* patient, see Whytt, loc. cit. p. 557.

[10] See Marshall Hall, On the Mimoses.

hunger on waking is usually wanting. In other instances, however, of the latter class the sleep may be heavy, but it is often unrefreshing and disturbed by dreams.

Many of the disturbances of the functions of other organs of the body have been already spoken of in connection with the description of special symptoms, and it is unnecessary again to repeat the remarks made on the subject of the appetite, the digestion, or the constipation and flatulence which, with some exceptions, mark these cases, nor on the irregular and scanty menstruation, or the leucorrhœa attendant on anæmia or chlorosis, whose influence has been already largely insisted upon. It has been observed that in many cases where hypochondriasis is most marked, oxaluria has been present. This symptom is, however, common to a great number of diseases, and in some cases it probably depends more or less directly either on an excess of animal food (Niemeyer)[1] or on imperfect assimilation, when its occurrence is rather to be associated with dyspeptic disturbances of another character, where the hypochondriasis, instead of being primary, is secondary to the disorder of the digestion, than with the more purely nervous disturbances now under consideration. In others, however, it appears to be directly associated with nervous disturbances of this class.

One important variety, to which Whytt first called attention, is that where severe disorder of the stomach occurs in connection with the gouty diathesis, and ceases with the appearance of the disease in one of the joints.[2] The attacks, however, as Whytt further remarked, are less liable to affect robust and strong individuals in whom the gouty affection is regularly developed, than in those of "weak fibres and very sensible nerves," who have "rarely any disorder like true gout," but who are liable to "craving or faintness, nausea or vomiting, flatulent swellings, borborygma, low spirits, cramps, convulsive and violent pains in the stomach and bowels, and an increased secretion of saliva." In other cases severe spasmodic affections of the stomach occur in the course of gouty attacks, and are characterized by violent abdominal pain, intense distension from flatus, and severe sinking, followed in some instances, when wine has been drunk, by acid vomiting, which has given relief.[3] The nature of these disorders is, however, a matter of some doubt; and though evidence regarding them is still wanting, there is considerable probability that many of them are not simple neuroses, but are rather to be classed under the category of acute indigestions, complicated by a predominance of nervous excitability together with prostration.

[1] Loc. cit. i. 554

[2] Works, pp. 556, 559.

[3] See a case by Sir C. Scudamore, quoted by Dr. Garrod, "Gout," p. 503.

Prognosis.—The course of these affections is, as may be inferred from their history, very variable. Their duration depends in a large measure on the persistence of the exciting cause, ceasing with its cure, as is often observed in cases originating in anæmia or chlorosis, or in those arising from reflected irritation, especially when the cause is seated in the uterus.[1] The rapidity of their disappearance on the supervention of some other nervous phenomena affecting other parts, or of an attack of gout in cases when this diathesis is present, has already been a subject of remark. Barras[2] has observed that in some cases they disappear on the supervention of acute diseases, as fevers,[3] pneumonia, abscess, or variola, but are liable to reappear during or after convalescence.

The majority may continue for years with but little danger to life; and this is true not only of the minor degrees of hypochondriacal uneasiness, but even of some of the severer cases of hysterical pain and vomiting. The hysterical forms, like all the other phases of this malady, are liable to diminish in severity and even to disappear with advancing life.[4]

Briquet remarks that the vomiting of hysteria, though sometimes very obstinate, is the least dangerous of these affections. That it may, however, be attended with fatal consequences, and especially when constantly ensuing after everything eaten, and when associated with severe pain is evident not only from his, but also from observations recorded by Andral, and Barras, and Budd. The danger resulting to the general nutrition from the more absolute forms of anorexia has already been remarked upon.[5]

The uncontrollable vomiting of preg-

[1] An interesting case of this kind is quoted by Henoch, from the third edition of Romberg's work. Henoch says that in some cases of cardialgia the pain has been known to occur only at the menstrual periods, *to cease with pregnancy, and to return after delivery.*

[2] Loc. cit. i. 539.

[3] Τὰ σπασμώδεα καί τετανώδεα πυρετὸς ἐπιγενόμενος λύει. (Hippoc. Prænotiones, Works, Kühn's Ed. i. 289.)

[4] "Progrediente ætate cardialgia crebro sponte evanescit; multas novi mulieres, quæ tempore juventutis et ætate frequentissime hoc malo macerabantur, ad senium perventas ab eo omnino immunes viventes." (Schmidtmann, loc. cit. iii. 207.)

[5] Of course this must not be confounded with those simulated forms of anorexia where the patients eat by stealth.

nancy may also at times assume a very dangerous character. Thus, of fifty-eight cases collected by Cartaya,[1] thirty were fatal, and twenty-eight were cured after abortion or the death of the fœtus—fourteen of the latter having had premature delivery induced with success, while one recovered after the application of leeches to the os uteri, and two through the use of champagne.

The Pathology of the functional disturbances of the stomach, of which the description has here been given, is involved in the obscurity which attends that of a large class of nervous affections, and of which, indeed, it may be said, that our knowledge consists rather of isolated facts than of comprehensive inductions. Many of the leading phenomena, attesting the influence of the nervous system in the production of the symptoms here alluded to, have been already considered, and the author has but little to add to what has been before stated, except to pass briefly in review some of the better known conditions of nervous disturbance which are applicable (in many cases, however, only inductively) to these affections.

It is well known that excessive excitability of the nervous system stands in an almost inverse relationship both to the due co-ordination and to the efficiency of the functions under its control, and that conditions of weakness or mal-nutrition of the nervous centres are evidenced by perversions in the harmony of their action characterized by an apparent excess of activity in one direction, but attended by deficiency in another.[2]

Both the sensory nerves, and also those supplying both the voluntary and involuntary muscles (including among the latter the contractile coats of the bloodvessels), are subject to similar perversions of action. Thus it has often been noticed that when any part is the seat of severe pain, its power of distinguishing sensations is proportionably impaired, and local hyperæmia very frequently ensues. Hyperæsthesia is also occasionally combined with muscular paralysis or with convulsive movements, as may be sometimes observed in neuralgias of the fifth nerve.

The experiments of Lister and others have shown that the actions of the visceral and vaso-motor nerves are exalted by impressions of moderate intensity made on the nervous centres, but are paralyzed when these are carried to extreme degrees of stimulation. It is further highly probable that these impressions can be equally produced by peripheral stimulation of the sensory nerves as by direct excitation of the central roots of the motor fibres; and, therefore, the reflex effect resulting from the former will depend not only on the sensibility of the peripheral branches, but also on the degree of excitability of the nervous centres. Hence when this excitability is excessive, the effects of a moderate peripheral stimulus will resemble those produced artificially by excessive direct stimulation in the healthy state, and will give rise to paralysis or convulsion according to the proportion borne between the amount of stimulus and of the excitability present. Dr. Handfield Jones[1] has also adduced some reasons for believing that vaso-motor paralysis, determining excessive secretion, may coexist with undue irritability of other nervous branches, since excessive secretion from the eye and nose are known to be frequently attended with hyperæsthesia of the sensory nerve of these parts. If this view be correct, it is comparatively easy on the data above given to frame an hypothesis, with relation to these affections of the stomach, explanatory of the phenomena of hyperæsthesia associated with secretions either excessive in amount or perverted in quality, and also with spasmodic movements indicated by vomiting, and occurring in conditions signalized by morbid excitability of the nervous centres. The cases also in which reflected nervous action is observed to proceed in unusual, and probably in abnormal directions, appear to be explicable by the same data, and are further illustrated by some striking examples of such occurrences in parts more directly accessible to observation.[2]

The effects of anæmia as a cause of local pain, to which some allusion has been made by recent writers, and especially by Dr. Anstie, may possibly serve in some cases to explain the sensation of pain felt when the stomach is empty, and also its relief by food, which causes an increased afflux of blood to the part; and it is not without its parallel in the neuralgias of other parts, which are cured by a blister placed on the course of the nerve, or directly on the seat of pain.[3]

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[1] Schmidt's Jahrbücher, 1855, iv. 60.

[2] Thus (to cite familiar instances) a muscle in violent convulsion is unable to execute voluntary movements; a weak eye is conscious to a morbid degree of the impression of light, while its power of distinguishing objects is diminished; mental excitement, attended with rapid thought and vivid imagination, is generally deficient either in perspicacity of ideas or in the power of sustained attention or of logical precision.

[1] Functional Nervous Disorders.

[2] See an interesting case cited by Dr. H. Jones, "Functional Nervous Disorders," p. 11, of paralysis of the muscles of the eye, attended with circumorbital pain, resulting from necrosis of one of the phalangeal bones of the hand.

[3] Anstie, Stimulants and Narcotics, p. 214.

Of any special anatomical conditions discoverable in these cases we are as yet in ignorance; in fact, the absence of these constitutes their distinguishing feature, as contrasted with those cases where such lesions are found to explain the phenomena observed during life.

The question regarding the possibility of organic disease resulting as a consequence from long-continued disturbances of function, excited through the nervous system, is of very considerable importance, but distinct clinical evidence of any anatomical lesion of the *stomach* having originated independently from this cause is very defective, and the general question is of too wide an extent to permit of its appropriate discussion in this place.

DIAGNOSIS.—The diagnosis of the several forms of nervous disturbance from those arising from the organic diseases, the symptoms of which they more especially simulate, is often a matter of extreme difficulty.

(*a*) The chief criteria upon which reliance must be placed, are the recognition of a constitutional state predisposing to nervous excitability, and particularly the presence of conditions of great exhaustion or the hysterical diathesis.

(*b*) The presence of causes of sympathetic irritation, and the aggravation or alleviation of the symptoms of the stomach affection in a direct ratio with an increase of diminution of the severity of these.

(*c*) The disproportion observed between the severity of the gastric symptoms and the general state of the patient, and particularly the absence of emaciation when severe vomiting forms a prominent feature. The evidence from cachexia is of less value, since anæmia is frequently associated with nervous disturbance; and chlorotic females, whose menstruation is disordered, are frequently the subjects of ulceration of the stomach.

(*d*) In the case of pain, its frequent complete remissions are almost diagnostic of the absence of inflammation, though by no means excluding the possibility of its cause being due to either ulcer or cancer. Pain from inflammatory affections, unless due to corrosive poisons, seldom, however, presents the intensity of suffering produced by neuralgias of the stomach. The seat of the pain, and especially of tenderness, requires careful investigation; and when this is exclusively superficial,[1] it would strongly favor the opinion of the nervous character of the disorder, even when under these circumstances it is allied with vomiting.[1]

(*e*) Pain occurring when the stomach is empty, and relieved by food,[2] is almost distinctive of its nervous origin. Exceptional cases of this nature have indeed been observed in ulcer and cancer, but they are of great rarity. The influence of the nature of the food upon the pain, and also upon vomiting, is another criterion, which is not without value. It has, however, been occasionally noticed in exceptional cases of ulcer, that stimulants have given relief.

(*f*) The coexistence of other neuralgiæ, and the alternation of pain with these, are also a strong ground for suspicion that the affection of the stomach belongs to the same class. Intercostal neuralgia is, however, of minor value as a means of distinction, as it may be observed in some cases of ulceration. Dorsal pain is common in both classes, and affords but few positive features of distinction between them. Spinal tenderness, though commonly present in cases of Neuralgia, is occasionally absent, while on the other hand it may exist in cases of ulceration. The presence of other neuroses is also a valuable aid, though it must be remembered that in some females excessive sensibility may coexist with an inflammatory condition of mucous membrane, and that in such cases the recognition of the latter is of great importance in relation to treatment.

(*g*) Vomiting from nervous disturbance often resembles that arising from cerebral causes in the facility with which the act takes place, and particularly in the absence of relief to the pain or nausea which attends the evacuation of matter irritating a stomach which is the subject of organic disease. The coexistence of pyrosis with pain affords but little conclusive evidence as to its origin, since this symptom may arise from causes both of organic and of purely functional nature, the character of which must be determined by the attendant symptoms.

(*h*) The absence of pyrexia usually distinguishes these affections from those of inflammatory origin, though it is of no value in their diagnosis from ulcer and cancer, in which disorders a febrile state

[1] I have known, in some cases where, from the presence of hæmatemesis and of severe pain occurring immediately after food, there was the strongest suspicion of the existence of ulceration, there was yet great superficial tenderness. Careful examination, however, revealed the existence of tenderness on deeper pressure in limited portions of the epigastric region.

[1] See Briquet's cases, before quoted.

[2] A craving for food is sometimes experienced in cases of chronic catarrh, and also of ulcer; but when yielded to, it usually aggravates the uneasiness. There are, however, exceptional cases of an hysterical character, before alluded to, where, though a strong desire for food exists, it is speedily followed by vomiting.

is very seldom observed except from the presence of some other inflammation capable of exciting it.

(*i*) The state of the tongue usually serves as an additional guide in the diagnosis from inflammatory affections. It is usually unaffected when the disturbance is of nervous origin; its characters in the catarrhal states have been already described.

On the other hand, the tongue is of little value in the distinction of the neuroses of the stomach from ulcer and cancer, where the appearances which it may present are very uncertain, and depend more on the presence or absence of the complication of catarrhal states than on any other cause.

(*k*) The diagnosis of severe attacks of spasm in gouty cases from those of inflammatory origin is one of considerable obscurity, as the intense depression often masks to some degree the inflammatory symptoms. The chief symptoms which should create suspicions are febrile disturbance, a loaded tongue, tenderness on pressure at the epigastric region, and burning or heat at the stomach, as distinguished from the cramp-like pain which usually marks the attacks of a more spasmodic form.

The Treatment of the various forms of nervous disturbance of the stomach may be briefly summarized as consisting in modifications of the tonic and stimulant plan already recommended for atonic dyspepsia; and their cure under this system affords further and valuable evidence of their true nature.

The discovery and cure of any source of peripheric irritation from which the symptoms may originate is of the very first importance. It does not, however, seem necessary to do more than to remind the reader of the frequency with which in the female sex these diseases have their starting-point in uterine disorders. It will, however, conduce somewhat to perspicacity if the remedies which may be more particularly directed to the condition of the stomach are mentioned in relation to the symptoms for which they have been found most efficacious.

In the relief of neuralgic pain iron holds a prominent place.[1] In the majority of instances the neutral preparations, and especially the carbonate, are both the most serviceable and also the safest. The dose should not exceed five grains, since larger ones often provoke colic and intestinal disturbance (Trousseau). Some writers, however, as Abercrombie, Dr. Handfield Jones, and Henoch, recommend the sulphate in doses of one to two grains. Henoch advises that it should be used in combination with morphia, and Abercrombie with aloes and pulv. aromat. taken twice daily, and the latter formula will at times be found serviceable when constipation is present.

Arsenic has been found very useful by Dr. Leared[1] in cases of severe neuralgic pains when there are no signs of irritability of the stomach, as evidenced by redness of the tongue, and pain following immediately after the ingestion of food. When this symptom has however appeared in phthisis, Dr. Leared has also found arsenic useful. The cases where it is most indicated are those when the neuralgic condition has followed mental or physical exhaustion, and in those of malarial origin.

Nux vomica is very useful in these cases, as also in some forms of pyrosis.

Bismuth and the nitrate and oxide of silver are also valuable. Hydrocyanic acid has appeared to the author of inferior efficacy in relieving either pain or vomiting of nervous origin.

The utility of opium in painful affections of the stomach can scarcely be overrated, though the usual caution is necessary with respect to its habitual use. A single dose will often permanently relieve pain of many days' standing, and its value has been strongly insisted upon by most writers of these disorders.

It is of special use in gastrodynia arising from anxiety and exhaustion, but its value is not inconsiderable in many hysterical cases; and it has been remarked that, when it agrees, its effects in producing constipation are scarcely perceptible.

In pyrosis, bismuth combined with opium seldom fails to relieve; though, in order to complete a cure, a more direct astringent is sometimes necessary, and for this purpose the compound kino powder is the best remedy that can be employed. Pain from flatulence is in these cases best treated by ether or by aromatic spirit of ammonia, and the former agent is sometimes useful in checking hysterical vomiting. Trousseau[2] speaks highly of the use of valerian and assafœtida in the wearing uneasiness which he terms "anxiété épigastrique."

In the general irritability of the nervous system, associated with dyspeptic symptoms and oxaluria, which occur among the effects of anxiety or exhaustion, the sulphate of zinc, first recommended by Dr. Golding Bird,[3] and the oxide, subsequently used by Dr. Marcet[4] in cases where the same symptoms have followed the use of alcohol, and even in some

[1] See especially Andral, Clin. Méd. ii. 223, and Dr. Martin's case, before alluded to.

[1] Brit. Med. Journ. 1867, vol. ii.
[2] Traité de Thérap, ii. 307.
[3] Loc. cit. p. 256.
[4] Chronic Alcoholic Intoxication, p. 100.

where the latter cause has not existed, often prove of considerable service. They both seem to act as "tonics" in this condition, and the oxide has the additional advantage, if given at bedtime in doses of from two to three grains, of procuring sleep.

When the pain is very severe, relief has sometimes been experienced from the application of plasters of belladonna or of opium to the epigastrium, or from counter-irritation in this region by means of croton oil or blisters, and the latter may be followed by the endermic application of morphia.[1]

In obstinate cases it may be well to try Briquet's recommendation of faradization.

Vomiting is sometimes a very difficult symptom to overcome, and the possibility of its fatal termination has been already alluded to. When very severe it is important to give the stomach rest by the employment, during a certain period, of nutritive enemata, a plan which should never be omitted when vomiting, from whatever cause, is severe and obstinate. The value of rest is further illustrated by a case quoted by Sir T. Watson and other writers from William Hunter,[2] where a boy, reduced to an extreme degree of emaciation by constant vomiting, attended by severe pain, was fed by spoonfuls only of milk frequently repeated, with the effect of completely arresting the vomiting, and enabling the stomach to bear more substantial food, the result being that the patient was completely cured; and numerous cases since recorded have confirmed the advantages of this method.

Opium is often of considerable value, and I have known a few doses of three or four drops of laudanum speedily check vomiting resulting from disease of the uterus, which had persisted for some weeks previously. It may be given an hour before meals, and in severe cases its administration by enemata may often be resorted to with advantage. [Hypodermic injection of morphia, also, will give relief; but the patient must beware of the *morphia habit*.—H.]

Iced effervescent drinks, combining the effects of cold with the sedative[1] effects of the carbonic acid, also prove useful; and benefit is sometimes experienced from the use of champagne, and also from effervescent draughts containing hydrocyanic acid.

Bismuth, as has been remarked by other writers, is of comparatively little service when vomiting is purely sympathetic, and particularly when it arises from disorder of the uterus; but when any inflammatory state is present and complicates the nervous disturbance, it may often be employed with advantage combined with hydrocyanic acid.

The oxalate of cerium (first introduced into practice by Sir J. Simpson,[2] of Edinburgh) has been found very efficacious in some cases of vomiting in pregnancy. It should be given in pills in doses of one or two grains.

In many of the milder cases of acid vomiting or troublesome heartburn of pregnancy, hydrochloric acid combined with tincture of nux vomica, given before meals, often proves of service. I have seen less benefit result from the use of the acid alone; and part of the efficaciousness of the remedy is in my opinion due to the influence of the nux vomica.

Pepsine is also occasionally of value in these affections, though the mode of its operation is not very intelligible; but the administration of one or two doses is sometimes sufficient to enable the food to be retained, and the habit of rejecting it, being once broken, seems in some cases to be the essential feature of the cure.[3]

Among other remedies that have been found efficacious in hysterical vomiting are the douche, shower-bath, or cold affusion to the body and abdomen.[4]

In the vomiting of pregnancy, Bretonneau reports that he has found great service from frictions of belladonna over the hypogastric region;[5] and the applications of the extract to the cervix uteri has been made with the same intention by Cayeaux[6] with good effect.

Acupuncture has also in some cases been efficacious,[7] and in others faradization[8] has been found of value.

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[1] It is probable that in many of the cases where the efficacy of such remedies has been recorded, the pain so relieved has more truly been seated in the abdominal muscles, where, as before remarked, its presence may complicate the gastric pain. In some of these cases the hypodermic injection of one-sixth of a grain of morphia over the seat of tenderness has afforded relief, and I have known this plan to be most efficacious in the severe pain associated with a cancer of the stomach which had formed adhesions to the anterior abdominal wall.

[2] Med. Obs. and Enquiries, vol. v.

[1] Pereira, Mat. Med. i. 125. Sir J. Simpson's Obstetric Works, ii. 769.

[2] This point has been ably insisted upon by Dr. Chambers.

[3] Sir J. Simpson's Obstetric Works, i. 313.

[4] Andral, Clin. Méd. ii. 196. Barras, i. 480, quotes a case from L. Frank, where a lady, who had vomited her food for eight years, retained it when taken in a bath.

[5] Trousseau and Pidoux, Traité de Thérap. ii. 76.

[6] Ibid.

[7] Ibid. i. 190.

[8] Briquet, before quoted, p. 218. Bricheteau, Bull. Gén. Thérap. lxi. 417. Debout, Bull. Thérap. Aug. 30, 1863.

The internal administration of tincture of iodine has been known to check the vomiting of pregnancy,[1] but it does not appear to have been tried in this country, and I have no experience of its efficacy.

Finally, it must be recollected that troublesome vomiting apparently of the same kind may sometimes be caused by constipation, and that the use of aperients may be absolutely necessary to overcome it. In these cases the mixture of carbonate and sulphate of magnesia in doses of a scruple of the former to two drachms of the latter in some aromatic infusion should be administered repeatedly every four or six hours, or castor oil may be taken on several successive mornings until the bowels have acted freely.

The foregoing list, though affording a great variety of choice, indicates also that there are probably concealed differences in the nature of the affections for which they are found useful, which are not as yet fully elucidated. The more ordinary kinds of neuralgic pain, when independent of causes of reflex origin, are as a rule easily controlled by iron, nux vomica, opium, ether, nitrate or oxide of silver, hydrocyanic acid, bismuth, or arsenic; but it is in the cases of severe hysterical pain and vomiting, or where these symptoms originate from causes of irritation in distant organs, that the greatest difficulty is experienced, and in these there is a considerable degree of uncertainty in the effects of treatment.

In the nervous disorder of the digestion which has been described as associated with diarrhœa, opium before meals, or administered in a clyster at bed-time, often affords relief; but I have known cases in which the health was only finally re-established after the use of nux vomica and hydrochloric acid. Patients suffering in this manner should avoid hot fluids at meals, and abstain from tea in the evening. In fact, in most of the nervous affections which have been here described, the use of tea and coffee, and especially of the latter, is injurious, and often serves to excite pain even after it has been allayed by treatment.

The majority of cases of spasmodic pain supervening in the course of gouty attacks are to be treated with large draughts of warm water, and with ether, musk, or camphor. [Oil of cajuput, five or six drops at a dose (conveniently on a lump of sugar) is often very promptly effectual. —H.] The sense of distension and load at the stomach, and the relief often experienced from vomiting, are not, however, to be taken as indications for the administration of stimulant emetics; for in such cases inflammation of the stomach, if not already present in some degree, is very liable to be excited by any undue irritation of the mucous membrane. It is desirable in all cases to promote by hot pediluvia or by mustard cataplasms the return of the disorder to the feet, and cases are recorded where this has been followed by immediate relief to the stomach symptoms.[1]

[1] Clarus, p. 840.

IV.—Gastritis.—Acute Gastric Catarrh.

Synonyms.—Catarrhe de l'Estomac (Pinel); Gastritis Erythematica; Erysipelas Stomachi; Ventriculi Inflammatio (Boerhaave); Febris Stomachi Inflammatoria (Hoffmann); Febris Mucosa (Typhoid?); Inflammatory Dyspepsia (Todd); Gastrite, Embarras Gastrique—French; Magenentzündung, Magen-Catarrh—German.

Varieties.—Gastritis Erythematica, G. Phlegmonodea: *Cullen.* Erythematous Gastritis, Gastritis with Alteration of Tissue, Follicular Gastritis, Gastritis with Alteration of Secretion: *Billard.* Gastrite Primitive, Gastrite Secondaire: *Valleix.* Phlegmonous, Catarrhal, Rheumatic Gastritis: *Hildenbrand.* Catarrhal, Croupous, and Diphtheritic; Inflammation of Lenticular Glands; Inflammation of Submucous Tissue: *Rokitanski.*

Definition.—An acute disorder of the stomach, characterized by depression and prostration, with or without pyrexia, by anorexia, nausea, vomiting, and in severe cases by pain after food, and depending on an inflammatory condition of the mucous membrane.

The terminology and real nature of this affection have been involved in much obscurity from the variety of the affections confounded under this title, including the specific fevers on the one hand, and on the other post-mortem softenings, ulcer, and cancer of the stomach.

There is no question but that acute typical gastritis, unless when caused by acrid poisons, is a comparatively rare affection, and equally so is the disease corresponding to Cullen's G. phlegmonodea, when suppurative action takes place in the submucous tissue. Its milder forms, corresponding to the catarrhal affections of other mucous membranes, are, however, exceedingly common, and constitute the cause of the majority of the acute attacks of indigestion which occur either spontaneously or in the course of other diseases. The distinction, however, between the acute and chronic stages of inflammatory affections

[1] See Dr. Copland's Med. Dict. vol. ii. p. 39; also Dr. Garrod, before quoted.

of the stomach is not always capable of being drawn with great accuracy, since, as remarked by Chomel, many persons liable to the disease may often suffer from a succession of subacute attacks, which, being excited by slight causes, may imperceptibly pass into one another, and thus acquire the character of a continuous disorder.

ETIOLOGY.—This disease is common at all ages, and in both sexes. It is said to have been observed in the fœtus.[1] In infancy[2] also, and at the periods of dentition, it is easily excited by food unsuited to the digestive powers of the stomach, or improperly prepared by suitable mastication; and in advanced life the latter cause, together with the enfeebled nutrition of the organ, render it liable to be affected by similar influences.[3]

Weakened states of the general system or of the stomach, which diminish the secretion of the gastric juice, are also frequent causes of inflammatory irritation, owing to the food introduced not undergoing its normal changes, and thus acting as a source of inflammatory irritation. Hence, among its predisposing causes must be enumerated many of those giving rise to general atony, and especially the presence of chronic exhausting diseases, or the period of convalescence from acute disorders.

A similar influence has been attributed to the effects of inanition or starvation, owing to observations of Hunter[1] and Blundell,[2] where the stomach in such conditions has been found softened after death. Andral[3] also met with ulcerations, and other writers[4] have mentioned that nausea and vomiting have been observed under these circumstances. Such a result is, however, by no means constant;[5] and though it is possible that inflammation may in some cases be caused by the participation of the stomach in the mal-nutrition which occurs in all the tissues under such circumstances, as well as by the arrest of its normal physiological functions, yet it is more probable that in most cases it is due to the effect of food imperfectly digested after periods of prolonged inanition.[6]

As exciting causes must be mentioned irritants of all kinds, including those whose action is purely mechanical, but especially the mineral and vegetable acrid poisons, and particularly arsenic,[7] and tartar emetic,[8] mustard, and ipecacuanha when administered as emetics.

In the same category are to be placed substances of an unsuitable character

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[1] Andral, Path. Interne, i. 17. Rayer, Dict de Méd. x. 134.

[2] It is important that the junior practitioner should remember, what is seldom mentioned in systematic treatises, that certain causes may affect the milk given to infants, through which it often proves a source of severe gastro-enteric catarrh. Menstruation occurring during lactation is one of these; and in infants brought up by hand on cow's milk, vomiting and purging are frequently excited when the animals are fed on turnips or mangold.

[3] These remarks apply to the acuter forms alone. The only two authors, Dr. H. Jones (Dis. of Stomach, p. 74) and Willigk (Prag. Viertel-Jahresch. li. p. 28), who have made observations on this head, have included both recent and chronic catarrh in their statistics; and in these taken collectively, the tendency to increased frequency of occurrence with advancing age is very striking. Willigk's observations, however, only begin with ages from thirty upwards; and of twenty-three cases, by Dr. H. Jones, "eleven were past fifty years, and fifteen past forty years of life." I believe, from my own observations, that the increased frequency of gastric catarrh in the later periods of life will be found rather to affect the chronic than the acuter forms.

[1] Phil. Trans. 1772, "Observations on certain Parts of the Animal Economy."

[2] Quoted by Dr. Hodkgin, "Morbid Anatomy of the Mucous and Serous Membranes," ii. 309.

[3] Path. Interne, i. 15. Essai d'Hématologie Pathologique, p. 82.

[4] See especially a letter from Mr. Malcolmson to Lord Hardinge, on the effects of a diet of bread and water on prisoners in causing total loss of appetite, constipation, or diarrhœa with slimy discharges, together with fever, a swollen red tongue, and great prostration. Quoted by Budd, loc. cit. p. 96, who gives other cases.

[5] See Chossat, "Rech. Exp. sur l'Inanition;" Barras, loc. cit. p. 522; also Taylor's "Medical Jurisprudence."

[6] Chossat found that pigeons in a state of starvation could not digest the food given them, and that under these circumstances they suffered from diarrhœa; and other illustrations of the same fact occur in the histories of persons who have suffered from starvation. Barras (ii. 168) says that after the season of Lent many persons suffer from indigestion. Two facts, observed by Bidder and Schmidt, deserve to be borne in mind in relation to this question, viz., that after a moderate period of fasting the secretion of the gastric juice is increased, but that after longer abstinence it is diminished.

[7] The use of arsenical paper-hangings has also caused the same condition, an instance of which has come under my knowledge, where a previously healthy child was seized with violent vomiting, in which blood was brought up, while sleeping in a room so papered. Dr. King Chambers has narrated a similar case.—"Indigestions," p. 217.

[8] Andral, Clin. Méd. i. 246.

taken as food, such as decomposing meat or vegetables, or shell-fish in some special conditions—which latter seem to have a peculiar efficacy in this direction. The same effect may, however, be due to alimentary substances which are not directly injurious, taken in excess of the digestive powers of the gastric juice, though their influence in this respect must to some degree depend upon their relative digestibility. Similar consequences may ensue from causes operating through the nervous system suddenly arresting the process of indigestion, and thus reducing the food which has been taken to the position of a foreign body, and consequently an irritant to the stomach.

Drinking largely of cold water when the body has been heated is also mentioned as a cause of catarrh of the stomach. Sudden changes of temperature have had a similar influence attributed to them ;[1] and climatic conditions appear sometimes to act in the same direction, for catarrhal affections of the stomach are most common in changeable weather, with cold and high winds, as in the spring and later autumn,[2] and also during the severe heats of summer and early autumn.

There appears to be a certain amount of evidence to show that epidemic influences have some share in producing this disorder. Thus Sydenham describes in the years 1669-70-71-72, as coincident with dysentery, and following an epidemic of "cholera," a fever setting in with gripes, headache, a moist tongue with a thick fur and aphthæ, *cured in six days by purging and low diet.*[3] Barras[4] remarked, that during the cholera epidemic of 1832 affections of the stomach were very common. P. Frank[1] ascribed them to a *constitutio annua*, and Schmidtmann[2] to a *constitutio gastrica*, independent of any special kind of weather. Chomel has remarked the coincidence with cholera of the cases of vomiting which he terms "*dyspepsie acide grave.*" During the height of the epidemic in August, 1866, I was much struck with the frequency of subacute inflammatory affections, corresponding in their symptoms to the state known by the French as "embarras gastrique ;"[3] and Barthez and Rilliet[4] consider the probability of this affection and of other forms of gastro-intestinal catarrh taking place under epidemic influences as very strong. It has also been stated that there is a special proclivity to gastro-intestinal catarrh during some epidemics of typhoid fever.[5]

There are several other diseases with which inflammatory conditions of the stomach so frequently concur, that they may almost be considered as part of the general disorder. Many belong to the acute febrile affections ; and although the impairment of the functions of the stomach in them is not always due to changes of an inflammatory character—nor is it easy to explain why these should be prominent in some cases and absent in others—yet the influence of some is so well marked, that they deserve to be mentioned as almost constant exciting causes of gastric disorder. Among these may be mentioned cholera[6] and scarlatina,[7] erysipelas[8] and

[1] Guipon (Traité de la Dyspepsie, Obs. 21, p. 329) has recorded a case of a workman who, after exposure to the heat of a furnace, was seized with acute vomiting and pain at the stomach, and this accident was repeated several times.

[2] Broussais (Hist. des Phleg. ii. 456, ed. 1822) says that inflammatory affections of the gastro-intestinal mucous membrane were very common in the Venetian Friuli, but many of his cases can hardly be considered as examples of simple gastritis, and would now be considered as pneumonia, typhoid fever, or acute tuberculosis. Brighton has universally the reputation of making many "bilious" during early periods of their residence there; and Dr. J. Todd (Cyc. Pract. Med. art. "Indigestion") says that these disorders are common in Turkey, Greece, Italy, Spain, Nice, Genoa, and Marseilles; and that they often follow the *bise* in Switzerland, the *mistral* in Provence, and the *tramontana* in Italy. Willigk (Prager Viertel-Jahreschrift, li. p. 28) gives for 327 cases of acute and chronic catarrh combined, observed in five years, the following relative proportions between the number of cases occurring in the different seasons: Spring, 6·2; summer, 3·4; autumn, 2·9; winter, 2·5.

[3] Syd. Soc. Trans. i. 177, 181.

[4] Loc. cit. ii. 161, 162.

[1] De Curandis Hominum Morbis, i. 73–75.

[2] Summa, Obs. Med. iii. 300. There is no doubt that some of the epidemics spoken of by older writers, as by Elsaesser, Sarcom, Roederer, and Wagler ("De Morbo Mucoso"), P. Frank, and Reil, included cases of typhoid fever, "or of typhus complicated with dysentery" (Murchison). See J. Frank, Prax. Med. Univ. Præcept. 1811, vol. i. pars i. p. 244; also an analysis of this subject by Dr. Murchison, "Treatise on Continued Fevers," p. 393.

[3] See also the report in the Medical Times and Gazette, July, 1866, of the frequency of "embarras gastrique" during the outbreak of cholera at Amiens. A similar frequency of this complaint has reappeared during the present autumn (1871), at least in my private practice. I have not seen signs of gastric catarrh so common since 1866. Cholera has been prevalent in Europe, though not in England.

[4] Traité des Malad. des Enfants, i. 717, 732, 739, &c.

[5] Schmidt's Jahrbücher, 1863, pp. 123, 243. Bericht über die Krankenhäuser Wieden.

[6] Several observations on the effects of cholera in causing acute gastritis are also to be found in Andral, Clin. Méd. ii.

[7] Brinton, Diseases of Stomach, p. 57.

[8] Bamberger, P. Frank, Fenwick, Med.-Chir. Trans. xlvii.

measles;[1] and I have observed the same conditions in diphtheria,[2] variola,[3] puerperal fever,[4] phlebitis, pneumonia,[5] and pyæmia, and, with a less frequency, in typhoid fever. It is also a common complication of pulmonary tuberculosis, this condition having been met with in 28 per cent. of a series of cases of acute and chronic catarrh tabulated.[6]

Inflammation of the stomach has also been observed to follow the retrocession of gout and of acute rheumatism.[7]

It may also be considered a question deserving further elucidation whether some of the cases of vomiting in pregnancy, hitherto set down to reflex irritation, may not depend on alterations of a similar kind.[8]

[1] Barthez and Rilliet (Malad. des Infants, iii. 271).

[2] Sir W. Jenner has also seen diphtheria of the fauces associated with false membranes in the stomach ("Diphtheria," 1861, p. 4). This does not appear to be common, and, from Sir W. Jenner's observations, it is probable that its occurrence is somewhat influenced by epidemic character. (See also Squire, art. "Diphtheria," vol. i. p. 401.)

[3] See also Andral, Prec. Path. Anat. ii. 226.

[4] In a series of observations where my attention was specially directed to this point, I observed catarrhal affections of the stomach in only four out of nine cases of this disease.

[5] Originally observed by Dr. Stokes, Cyc. Pract. Med. iii. art. "Gastritis."

[6] See chapter on Chronic Catarrh.

[7] The former has not been proved by post-mortem evidence. Of the latter a fatal case is recorded by Andral, Clin. Méd. ii. p. 11. I have observed a case where the retrocession of the pains from the joints was followed by vomiting and diarrhœa, and a similar one is recorded by Chomel, Des Dyspepsies, p. 137. I have also observed in three cases in private practice intense gastric catarrh precede, in two cases by many days, and in one for many weeks, an attack of acute rheumatism.

[8] The majority of cases where examinations after death from this cause have been recorded speak of the stomach as showing little or no signs of disease. Virchow, however (Ges. Abhand. 778), has shown that in pregnancy the liver sometimes shows the same alterations as have been commonly noticed in the kidney, and which, under the title, "Cloudy Swelling," are recognized as indicative of an inflammatory condition. This state will be described in the account to be given of the pathological changes found in catarrhal inflammation of the stomach, as frequently forming the most characteristic appearance present. In the Dict. des Sciences Méd. vol. xvii. p. 382, art. "Gastrite," is recorded, by Guersant, a case of a woman dying from vomiting in pregnancy, in whom the stomach was found "*très-blanche*, un peu *plus épaissie* que dans l'état naturel, et *recouverte d'une mucosité abondante*."

The liability of the stomach to suffer from other causes inducing constitutional irritation and febrile action is illustrated by Abernethy's observations,[1] who was well acquainted with this effect of general disturbance of the system.

The question of the possibility of nervous disturbance chiefly arising from moral emotions, acting as exciting causes of the disease, has been already alluded to. There are, however, as has been before remarked, but few authentic or uncomplicated instances of this nature recorded. That they may act as indirect causes by arresting digestion, is very probable; but further proof appears to be required before their direct influence can be regarded as fully established.[2]

THE SYMPTOMS of recent or acute catarrhal affections vary considerably in intensity according to the degree of severity of the attack. They may be generally comprehended under the following category:—Uneasiness, distress or pain at the epigastrium—the latter symptom being, however, occasionally wanting, or not present to any marked degree, even in some of the severer forms of the disease; anorexia, more or less complete, vomiting, thirst, general malaise or prostration, headache, febrile reaction of variable intensity, thirst; constipation in some cases, diarrhœa in others. Beaumont's observations have shown that in slighter cases of this nature local uneasiness may be completely absent, and the disorder of the stomach may only be revealed by general malaise accompanied with slight headache. There are also differences observable in the character of the attacks, and the disorder may be described as existing in certain typical forms, between which, however, every shade of variety or resemblance may in different cases be found to exist. The principal of these are:—

(*a*) Acute indigestion and the "embarras gastrique" of the French authors.[3]

[1] Rayer (Dict. de Méd. x. 136) says that he has observed that inflammations of the joints, the kidneys, bladder, and serous membranes had an important influence in determining gastro-enteric inflammation, which was acute or chronic according to the severity and duration of its cause.

[2] With the exception of the case previously quoted from Andral, the recorded observations of this nature are chiefly in older writers. (Hoffmann, De Inflamm. Ventris Frequentiss. Op. vol. vi. 223–227; Blasius, Obs. Med. Anat. Rariores; Barry, Acta Reg. Soc. Med. Hannov. vol. iii., all cited in Copland's Dictionary.

[3] Many of these authors consider "embarras gastrique" as a distinct disorder, having nothing in common with the inflammatory processes. I cannot but regard this question as set at rest by Beaumont's observations,

(*b*) Febrile forms in which the fever is secondary to the disorder of the stomach.
(*c*) Acute catarrh in infants.
(*d*) Severe inflammation resulting from irritant poisons.
(*e*) Catarrhal affections of the stomach, complicating the exanthemata and other acute diseases.
(*f*) Acute catarrh of the stomach arising from alcoholic excess.
(*g*) Gouty inflammatory affections of the stomach.

(*a*) Acute indigestion may assume various degrees of severity according to its cause or the previous health of the patient. In some cases it may present only the phenomena of a trifling "bilious" attack; in others it may last many days or weeks.

Its origin will ordinarily be found in some of the causes temporarily disturbing the digestion; a moral emotion or severe exercise after a meal, indigestible food taken in excessive quantity, or food against which an idiosyncrasy exists on the part of the patient, are, however, among its most frequent causes. The first symptoms generally are a sense of fatigue, together with malaise, aching in the back or limbs, and a depression of spirits; these are soon followed by epigastric uneasiness and distension, and sometimes by severe cramp-like pain in the stomach. During these attacks there is often a sense of faintness, the extremities are cold and the pulse is weak, fluttering, and depressed, and the patient is often bathed in cold perspiration. Headache soon supervenes, generally frontal in position, sometimes of considerable severity, and not unfrequently associated with intolerance of light and sound. Nausea with increased flow of saliva follows, and the offending meal is rejected, accompanied by a great quantity of acid fluid; and with its expulsion the symptoms may cease. In other cases, instead of being vomited, the irritating matters pass into the intestines. Griping and colicky pains then ensue; in some cases a spontaneous diarrhœa is set up which carries off the peccant material, but in others constipation, associated with flatulence and spasmodic contractions of the intestines, continue until the bowel is evacuated by a purgative. In the latter cases, pain, sometimes acute, is felt at the epigastrium; or there may be only an excessive sense of uneasiness and of weight or load at the præcordial region. There are complete anorexia and loathing of food, and nausea continues, often attended with ineffectual attempts to vomit. The tongue becomes loaded with a thick creamy fur; and though the amount of this varies in different cases, being sometimes thin enough to allow the enlarged papillæ to appear through, it always retains its soft, moist, milky appearance; the breath is offensive, and thirst is generally a marked symptom. In other and severer cases the circulatory and nervous systems may participate in the general disorder; palpitation, dyspnœa, faintness, vertigo, or a confusion of ideas may supervene; and when in the case of elderly people an excessive amount of flatus is generated, cerebral congestion may occur to an extent sufficient to simulate an apoplectiform attack; while in children, and sometimes also in females, the implication of the nervous system may induce convulsive affections of the epileptiform character. [Dr. T. K. Chambers is probably right in the opinion, that this affection, when at all inflammatory, is seldom confined to the stomach, but much more often involves also the duodenum and liver. His appellation for it is then well chosen, "Gastro-hepatic Catarrh."—H.]

The headache which appears in the course of the slighter attacks of this nature often assumes a form with somewhat characteristic features, and which is familiarly known as the "*sick headache.*" It is most common when acute exacerbations are superadded to the ordinary forms of atonic dyspepsia; and hence it is most liable to affect those who are out of health, and whose digestions are weakened by sedentary employment, and who have a tendency to costiveness. It occurs, however, also in persons of apparently vigorous health, sometimes without apparent cause, but most usually after some indiscretion in diet, or after some of the causes liable to arrest the digestive process.[1]

The most usual time of its appearance is some hours after food has been taken, and very commonly the patient wakes with the pain at an early hour in the morning, especially when the last meal has been a late and indigestible supper. It may, however, supervene at any hour of the day. The attack is usually preceded for a longer or shorter period by some indistinctness of vision, sometimes affecting half the field of vision of one or both eyes; at other times diplopia occurs, or sight is disturbed by muscæ or by dazzling spots of light. Vertigo and noises in the ears may also appear among the

and think that the difference between these and severer affections is only one of degree—an opinion which is confirmed not only by their etiology, but also by the effects of treatment.

[1] Fothergill, who first described this headache (Med. Obs. and Enq. vol. vi.), attributed to "butter, fat meats, spices," and "meat pies," a special faculty in its production. Wood (Practice of Med. i. 564) says that it is frequently caused by excesses in the use of tea and coffee, but especially of the latter.

prodromata. These are usually soon followed by pain in the head, at first slight, but rapidly increasing, until it becomes of great severity, which most commonly affects one or both temples, the frontal or in rarer cases the occipital region. There is often acute throbbing pain in the eyeballs, which are tender to pressure; though when the pain in the head supervenes, the indistinctness of vision usually disappears. If the pain lasts long the scalp sometimes becomes tender, and it not unfrequently remains so for some time after the attack. During the paroxysm the surface of the head, and particularly the forehead, is often cold, and in some cases the pain itself may be partially relieved by hot fomentations; at a later period the skin of the head generally becomes hot.

Other symptoms accompany the attack. The physical and moral depression is, in severe cases, extreme; light and sound are equally intolerable; sighing, yawning, or shuddering are often present, together with an extreme sense of general chilliness, amounting at times to rigor. Nausea is very common, and vomiting of acid food sometimes occurs — this appears sometimes, but by no means constantly, to relieve the patient. In other cases there is a great sense of uneasiness in the lower bowels, leading to ineffectual attempts at evacuation, and the only effectual mitigation in such cases is that produced by a purgative. The attack may last only for an hour or two, or may persist for twenty-four or forty-eight hours. When it is severe, complete relief is rarely obtained until after sleep has been procured, though this is unattainable during the height of the paroxysm. After sleep the patient awakes either free from pain, but feeling weak and nervous, or sometimes with a dull aching in the head, which gradually disappears. A loss of appetite, and diminished digestive power, which sometimes entail a liability to a speedy recurrence of the attack, often remain during some days.

The nature and immediate causes of these attacks have been a subject of much discussion. Dr. Anstie[1] has recently adduced some good reasons for regarding the pain, when seated in the anterior part of the head, as a neuralgic affection of the fifth nerve, and it is not impossible that this may be its real explanation, since other neuralgiæ of this nerve have been observed to follow disturbances of the stomach. It would appear that these headaches may be immediately produced by undigested food, either remaining in the stomach or which has already passed into the intestines; and this opinion is corroborated by the methods through which relief is usually obtained. Whether any special conditions of the food or of the secretions are concerned in their production must remain, as heretofore, in the absence of positive data, a matter of speculation. [Sick headache is not unfrequently periodical. This happens both in men and in women; but especially with the latter. The interval may be, and usually is, irregular; but it is most apt to be two, three, or four weeks, with variations of a few days only. Sometimes this periodical affection, or liability, is hereditary. I have known it in three generations of the same family. Such cases are very hard to relieve, and almost impossible to cure, until after the cessation of menstruation. Then the headaches disappear spontaneously.—H.]

Anorexia, pain, and thirst, with a loaded tongue and great general depression, may sometimes continue for days, owing to undigested food being retained in the stomach, and may disappear after this has been evacuated by an emetic, but in other cases the irritation remains long after its cause has been removed. The persistence of the symptoms above indicated, with certain others superadded, then forms the "*status gastricus*," "*saburral condition*," or "*embarras gastrique*" of the German and French authors, which may in most cases be traceable to some of the causes above indicated, but in others it occurs apparently spontaneously, or it may result from fatigue, over-anxiety, or probably from some of the epidemic influences before alluded to. There is then tenderness, load, and uneasiness at the epigastrium, together with great disgust for food, which, when taken, increases the distress, or causes nausea, and sometimes vomiting of mucus, or bile, or food acid from fermentation, together with acid watery fluids. Thirst is a marked symptom, and there is sometimes a craving for acid drinks; the tongue is more or less thickly covered with a moist white or brown fur; there is a bitter, nauseous, and sometimes metallic taste in the mouth, and an increased flow of saliva has been occasionally noticed. Fetid and acrid eructations and heartburn are often complained of, and the breath is heavy and offensive. The bowels are, as a rule, confined. In some cases diarrhœa may have been present at the outset, with colic and griping, but on ceasing it is followed by constipation; in rarer instances, in which catarrh of the intestinal canal is also present, it persists throughout, and is then attended with griping and with pale watery stools, which often irritate the anus and rectum when passed. There is great physical and intellectual oppression, together with a sense of fatigue and weakness, which

[1] "On certain Painful Affections of the Fifth Nerve," Lancet, 1866, ii. 32.

may be the sole symptoms felt by the patient, or for which relief is sought; or these may be accompanied by a dull, confused headache, becoming sharper at intervals and not relieved by sleep. Sleep is unrefreshing, and is disturbed by dreams or nightmare. There are often rigors and slight horripilation of the skin, especially towards evening, with a certain amount of febrile reaction, ending sometimes in acid perspiration during sleep: an icteric tint of the conjunctivæ is very common. The pulse, except during febrile accessions, is generally depressed and weak, and slower than natural, though easily accelerated on slight exertion. If fever supervenes, it becomes quick and full, but easily compressible. Urticaria and herpes sometimes complicate these attacks: the former is often caused by shell-fish, or by substances against which the patient has a special idiosyncrasy;[1] the latter, when appearing in connection with acute attacks of indigestion, mostly affects the alæ nasi, the lips, and chin, and more frequently results from the use of malt liquors in persons with whom these habitually disagree, than from any other single cause with which I am acquainted.

The urine is usually scanty, acid, high-colored, and loaded with lithates on standing; it may in some forms of acute indigestion occasionally present traces of albumen.

The duration of such an attack is uncertain; when appropriately treated, it usually terminates in a few days, though a certain irritability and weakness of digestion may continue for some time after; but when neglected, or when food is indulged in as usual, or if alcoholic stimulants are taken in excess to relieve the flatulence or feelings of prostration accompanying the attack, it may be prolonged almost indefinitely in a subacute form.

(*b*) There are, however, severe forms of the disorder, marked by considerable febrile reaction, which are very difficult to distinguish from febricula, or sometimes from early stages of typhoid, but in which the febrile reaction appears to be in reality attributable to the stomach. One class of these cases is marked by epigastric pain of some severity, which is generally central, but which sometimes radiates into the hypochondria and extends to the back. The sensation is sometimes one of heat or burning, at others of load or constriction; but as a rule it does not present the same degrees of intensity as are observed in nervous gastrodynia or in the pain from ulcer and cancer. In other instances, however, pain is not complained of. Vomiting also occasionally occurs, and may be almost constant after everything taken, and be brought on even by the smallest amount of liquid—the matters rejected being mucus, sometimes tinged with blood; or bile in considerable quantities; and retching may continue even after the stomach has been emptied. The tongue in these cases may present the loaded "saburral" state before described, but it tends in a day or two to become red, raw-looking, and sometimes fissured; the papillæ are large and red, and the lips dry and cracked. Sordes sometimes appear on the teeth.

Thirst is usually considerable, and the appetite is completely lost.

Constipation generally persists, and sometimes with considerable obstinacy; but diarrhœa may occur, though this is comparatively unfrequent.

Rigors, to a mild degree, usually continue throughout the whole course of this affection. The skin is often hot to the hand, but except in cases of children the elevation of the temperature is rarely considerable, and seldom above 100° Fahr.; but in children it may reach 103° or 104° Fahr. There is generally a considerable exacerbation of fever in the evening, and the diurnal remissions may be almost complete. The pulse is frequent, but weak and compressible.

Prostration with restlessness, and pains, though only of moderate severity, in the back and limbs, also continue throughout the attack; and the headache, which is ordinarily frontal, is frequently severe. Sleep is usually disturbed; and in children delirium may supervene, or a semi-comatose condition may be observed, and strabismus occasionally occurs. I have never observed either sluggishness, or marked contraction, or inequality of the pupils. The urine is scanty and high-colored, and deposits lithates.

Cough is spoken of as a common complication. I have not observed this unless when from a common exciting cause, such as cold, a bronchitis has been set up simultaneously with the gastric catarrh. Cough, associated with pyrexia, should always be regarded as a symptom requiring a careful and suspicious investigation of the lungs, for the condition which has now been described is often the accompaniment of early stages of phthisis.

The duration of this complaint, in its acute form and under proper treatment, is seldom longer than a week or ten days; but if treated at the outset with tonics

[1] Mushrooms, cucumbers, almonds, oatmeal, pork pie, and mackerel (Budd, loc. cit. 266). Cubebs also has been known to cause it (Wood, Pharmacologia, i. 331). In some of these cases the invasion of the nettle-rash is not always accompanied with the signs of gastric disorder here mentioned. Herpes zoster, though preceded often by severe constitutional disturbance, is not so common a phenomenon of these attacks.

and alcoholic stimulants, it is liable to become almost indefinitely protracted, and to pass into some of the more obstinate forms of chronic catarrhal inflammation.

(*c*) In young children, especially in infants under six months, or at the period of weaning, improper or excessive food sometimes causes a general catarrh of the whole gastro-intestinal canal. This may find its chief expression in diarrhœa, which frequently precedes the vomiting; but in many cases the latter is often an important and even a dangerous symptom. There may be but little fever, and even when the skin over the abdomen is hotter than natural, the extremities and lips may be cold and bluish; and though the abdomen is sometimes tender, this is not constantly observed. Pain is, however, frequently evinced by cries, especially before the evacuations. These are liquid, watery, offensive, acid, and often grass-green in color; they generally contain masses of coagulated casein, and are often attended with straining or tenesmus; but when the attack is severe and the child much prostrated, they may be passed apparently unconsciously. The vomited matters consist of the coagulated milk returned in an intensely acid condition, and accompanied with much acid watery fluid. Thirst is frequently excessive, but fluids taken are often rejected almost as soon as swallowed. The patient rapidly loses flesh, and great prostration sets in early, so that the infant may have difficulty in sucking, though it drinks with avidity. The pulse becomes weak and fluttering, the fontanelles are depressed, the countenance is pale, the eyes are sunken, and the features have a peculiar pinched, sharpened appearance. Somnolence, passing into coma or convulsions, may at times complicate the other symptoms, but the latter phenomena are not frequent.

The course of this form is acute, and if not early checked, it tends towards a fatal issue.

I have occasionally observed affections of this nature, though of somewhat less severity, and occurring at the period of the first dentition, alternate in a remarkable manner with eczematous affections of the skin.[1]

It may be remarked that the symptoms of the choleriform diarrhœa of children correspond to a great degree, as far as regards the stomach, with those observed in true cholera in the adult. In the majority of the cases of this disease which have come under my observation, the stomach participated markedly in the catarrhal condition of the intestines,[1] and the thickly-furred tongue in many corresponded most closely with that of the "saburral" conditions which have been before described.

It appears, however, unnecessary to enter into fuller details of the symptoms of this affection, though it is not unimportant to bear in mind its pathological relationship to the class of diseases which we are now considering, and to remember that the diseased conditions excited by cholera may persist in the stomach long after the other leading features of the disorder have subsided. This has been observed by numerous writers, especially by Andral, Budd, and Chomel; and their experience can, I have very little doubt from my own observations, be confirmed by any who have had opportunities of following the history of patients who have been subjects of the latter disease. Chomel's[2] "dyspepsie acide grave," with its acid vomitings, is the counterpart of that observed in children; but I have great doubts whether such acidity is the result of hypersecretion, and not rather the consequence of rapid catalytic changes in the food taking place under the influence of the unhealthy secretions of the stomach, especially as in some cases recorded by other observers it was found to be greatly increased by farinaceous food.[3] [See Cholera Infantum in this volume.—H.]

(*d*) The symptoms of the typical acute form of gastritis are merely exaggerations of the milder varieties just described, the gradations observed consisting principally in differences in the degrees of severity; but the more marked characters of the disease are rarely met with except when the more violent irritants have been swallowed.

There is usually acute epigastric pain, though some remarkable exceptions have been observed in this respect by Dr. Habershon, even in cases where corrosive poisons have been taken.[4] Its characters are burning and lancinating; it often extends into the back, and, when the affection is severe, it is not relieved by vomiting, and is increased by pressure. It is often accompanied by spasm and rigidity

[1] In one case, in a strong and otherwise healthy child, the eruption of each tooth was either attended with an attack of acute eczema, or by an attack of vomiting with diarrhœa; and, during one of the latter, the gastro-intestinal symptoms suddenly ceased on the supervention of the eczematous rash. It appears difficult to explain these phenomena, except on the theory of some *materies morbi* in the blood finding an excretory outlet by the skin or mucous membranes.

[1] See report by author on appearances in cholera, Path. Soc. Trans. 1866–67.

[2] Loc. cit. p. 144.

[3] See Guipon, Obs. 91, p. 436.

[4] Oxalic acid, sulphuric acid, arsenic, and chloride of zinc. (Med. Times and Gazette, Nov. 20, 1859; and Diseases of Stomach, 1866, p. 41.)

of the abdominal muscles, and is aggravated by each descent of the diaphragm, so that the respiration frequently becomes wholly thoracic.

Vomiting is a constant symptom; it is frequent, and is brought on by the smallest quantity even of cold fluids. There is also violent retching, which continues when the stomach is empty. The matters brought up are mucous, often tinged with blood, or blood blackened by the fluids of the stomach, together with bile and watery fluids. Diarrhœa is present in some cases, together with colic, tenesmus, and bloody stools, especially after arsenic, antimony, or corrosive sublimate have been taken;—absent, or not so commonly met with, after the mineral acids, and caustic alkalies. There is complete anorexia, but great thirst. Prostration is marked, but often combined with agitation and restlessness. The face is pale and sunken, the voice weak or extinguished.[1] The skin is cold, and often covered with clammy perspiration, and the pulse is frequent and small. Hiccup is sometimes a very painful symptom, and may continue after the vomiting has ceased.

The duration of these symptoms is variable. Death may ensue with great rapidity by complete collapse; or the patient may linger for days and die from exhaustion; or long-continued irritability may persist for weeks, and subsequent dangers may ensue from hemorrhage, or from the contraction of cicatrices resulting from ulcerations in the pyloric region.

(*e*) The symptoms of inflammatory disorder of the stomach complicating other acute diseases are often considerably modified, or even masked, by the course of the disorders in which they occur. Anorexia and thirst are common to those in which we have no evidence to show that the affection of the stomach is of an inflammatory nature. I am inclined, however, to believe that in the majority of cases where, in addition to these, we find a loaded tongue and nausea after food, and even a slight degree of epigastric tenderness, this condition of the stomach is the cause of these symptoms much more frequently than is generally supposed to be the case, and I have had repeated opportunities of verifying this opinion by post-mortem examinations. In some, however—and this is particularly true of variola and scarlatina, and not unfrequently also of pneumonia—other and more distinct symptoms appear, in the form of vomiting. Spontaneous pain is not, however, usually present. Though these evidences of gastric inflammation are often more distinct in the disorders last mentioned than in some other of the acute diseases, yet, with regard to the whole class, the liability to this complication should be always recollected in considering the measures of treatment to be adopted.

(*f*) In the inflammation of the stomach that follows from drink the symptoms are often very obscure. Vomiting, except in the morning, is comparatively rare, and signs of tenderness can with difficulty be elicited on pressure. The loaded tongue, the absolute anorexia, and the thirst, serve however as signs of an inflammatory condition of the stomach, of which confirmation is afforded, in some cases of fatal delirium tremens, by post-mortem evidence, and in others, whose termination is more favorable, by the successful results of treatment directed towards this complication.

(*g*) Gouty attacks of inflammation of the stomach usually occur under two forms. The outbreak of the disorder is frequently complicated with all the symptoms before described as those constituting an acute attack of indigestion, which are sometimes relieved, but at others persist, when one or more joints have become the seat of the characteristic inflammation. The more severe and dangerous forms, however, are those attended by a sudden disappearance of the inflammation of the joints and by a simultaneous accession of epigastric pain and tenderness, together with vomiting, and accompanied by severe prostration, and these symptoms may proceed to a dangerous extent unless relieved by a return of the disease to its previous seat. Nor does the predominance of nervous symptoms in some cases at all preclude the possibility of even these being due to the suddenness and severity of the affection of the stomach, though the extreme degrees of flatulence and spasm which accompany them are in themselves almost sufficient to account for these phenomena.[1]

The Pathology of the symptoms here described involves the consideration of the *nature* of the condition in which they originate, and of the *anatomical alterations* by which they are accompanied, and upon which they in all probability depend. The evidence that these changes are of an inflammatory kind is in part directly demonstrable, and in part is the result of induction. In the milder forms we have seldom, if ever, an opportunity of experimentally verifying this opinion by post-mortem examination; but the observations of Beaumont, although too often forgotten in actual practice, seem to set this question conclusively at rest.

Having been conducted on a living subject, they possess the advantage of being

[1] It may be in some cases affected by the action of the irritant upon the epiglottis.

[1] See Garrod, On Gout, p. 505.

records not only of changes affecting the glandular tissues, but also of conditions of perverted vascularity, which in the stomach, as in external parts, are only apparent while the circulation is still maintained, and which speedily become indistinct after life has ceased.

The appearances observed by Beaumont cannot be better described than in his own words :—"There are sometimes found, in the internal coat of the stomach, eruptions or deep red pimples, not numerous, but distributed here and there upon the villous membrane, rising above the surface of the mucous coat. These are at first sharp-pointed and red, but frequently become filled with white purulent matter. At other times, irregularly circumscribed red patches, varying in size and extent from half an inch to an inch and a half in circumference, are found on the internal coat. These appear to be the effect of congestion of the minute bloodvessels of the stomach. There are also seen at times small aphthous crusts in connection with these red patches. Abrasion of the lining membrane, like the rolling up of the mucous coat into small shreds or strings, leaving the papillæ bare for an indefinite space, is not an uncommon appearance. These diseased appearances, when very slight, do not always affect essentially the gastric apparatus; when considerable, and particularly when there are corresponding symptoms of disease, as dryness of the mouth, thirst, accelerated pulse, &c., *no gastric juice can be extracted.*"[1] "Complained of headache, lassitude, dull pains in left side and across the breast, tongue furred into a thin yellowish coat and inclined to dryness. Eyes heavy and countenance sallow. The villous membrane of the protruded portions of the stomach very much resembled the appearance of the tongue, with small aphthous patches, in many places quite irritable and tender."[2]

"The gastric fluids extracted were mixed with a large proportion of thick ropy mucus, and considerable muco-purulent matter slightly tinged with blood, resembling the discharge from the bowels in some cases of chronic dysentery." . . . . "Flavor peculiarly fetid and disagreeable, alkalescent and insipid."

In other places he mentions the phenomenon of minor degrees of hemorrhage as not uncommon—"grumous blood exuding from several small points of the membrane."

It is remarkable that in many instances when these appearances were well marked, the symptoms experienced by the patient were but slight; and hence, *à fortiori*, we may conclude that when the latter are more severe, the anatomical changes are more considerable, though direct evidence of this is often unattainable.

The appearances[1] thus described are, however, much less distinctly seen in post-mortem investigations; and the difficulty also of appreciating such evidences as are derived from the apparent vascularity of the organ is often very considerable.

As regards the phenomena of the latter class, two propositions, the converse of one another, may be laid down as true with certain limitations to be immediately explained. Firstly, that considerable vascularity is not necessarily evidence of inflammatory action; and secondly, that an almost entire absence of this appearance by no means excludes the pre-existence of this process.

Evidence in favor of the first statement has been abundantly accumulated since the time of Morgagni,[2] and more fully by Dr. Yellowly in 1813,[3] who was shortly followed by Billard,[4] by Trousseau and Rigot,[5] and by Andral.[6] These authors have shown that partial hyperæmias and also general straining of the stomach may be determined by the position of the body, by the fluidity of the blood, and also by obstructions to its return from the abdominal organs existing in the vena portæ, the heart, or the lungs. Andral adds, that when death takes place during the act of digestion, hyperæmia of the stomach is generally found; but numerous exceptions will be found to this rule, when the examination has been made some hours after death.

[1] Loc. cit. p. 99.

[2] Loc. cit. p. 171.

[1] Pustular appearances of the glands have, however, been described by Rayer as occurring in the stomach (Dict. de Méd. x. 120), and also by Wahl (Virchow's Archiv, xxi. 579.) In the latter case mucedines were found in the glands. The appearance is, however, rare, and must not be confounded with enlargement of the solitary glands hereafter to be noticed. A similar appearance is described by Dr. Church, Path. Soc. Trans. xx. 165, when the mucous membrane of the stomach presented an appearance as if covered by smallpox pustules, which seem to have been due to enlargement of the tubular glands, but without degeneration of their epithelium. The glands contained bacterides, probably of post-mortem origin. Purpura had been present, and also vomiting for a month before death.

[2] De Caus. et Sed. Epist. xxix.

[3] Med.-Chir. Trans. iv.: "Observations on the Vascular Appearance in the Human Stomach which is frequently mistaken for Inflammation of that Organ."

[4] De la Membrane Muqueuse Gastro-Intestinale. 1825.

[5] Arch. Gén. xii.

[6] Various places in "Clinique Médicale," and in "Prec. Anat. Path." 1829.

Hyperæmia, of inflammatory origin, is almost invariably purely capilliform and punctiform. The latter appearance is due to small extravasations in the mucous membrane, and may arise from mechanical congestion as well as from inflammatory hyperæmia; and frequently the punctiform redness persists when the general injection, which may be reasonably presumed to have been present, has disappeared. Venous congestion and general imbibition can never, taken alone, be considered as signs of pre-existing inflammatory action. Nor is it always easy to distinguish, apart from other phenomena, the redness of congestion due to impeded return, from that which arises from inflammatory hyperæmia.

It appears, however, equally important to insist on the fact that although during life inflammation of the stomach is probably *invariably* associated with hyperæmia, yet that *post-mortem* pallor of its mucous membrane is no sign of the absence of previous inflammatory action; but that in here, as in other mucous surfaces,[1] even when inflammation has existed, the blood after death leaves the small superficial vessels.

It is only when stasis has existed to an extreme degree, or when punctiform extravasation has taken place from the capillaries, that the signs of inflammatory hyperæmia persist long after death; and even when present they seldom, except in cases of extensive inflammation from irritant poisons,[2] occupy more than patches of the surface.

Other changes, however, exist, which furnish safer criteria for the diagnosis of inflammation than can be derived from the absence or presence of vascularity taken alone. In the slighter forms they are, it must be confessed, somewhat difficult to distinguish, differing, as they do, only by a question of degree from those which occur in the physiological process of digestion, in which not only the vascularity, but also the color and consistence of the membrane are affected.

These changes consist in an increased opacity, together with swelling and with varying degrees of diminution of consistence of the mucous tissue. The two first of these are distinctly described by Beaumont; and the increased opacity gives to the mucous membrane (apart from the color produced by hyperæmia) a dead white appearance, corresponding to the "cloudy swelling" of Virchow which is observed in the kidneys in acute Bright's disease.[1]

Microscopic examination of the mucous membrane in this condition shows that the secreting cells, and also the nuclei, are swollen, irregularly distending the tubules, and are filled with granular matter soluble in liquor potassæ and dilute acids, which gives them, by reflected light, and as seen with a low power, the appearance of white lines, while by transmitted light they appear unnaturally dark and opaque. The cells also often contain fat globules in variable quantity, but in severe cases they frequently break down without undergoing fatty degeneration, and the tubes become more or less filled with granular débris and detritus.

It is to this distension of the glands, by an abnormal accumulation of protein matters in their interior, that the swelling of the mucous membrane and the pustular appearance observed by Beaumont are chiefly due. The normal secretion of gastric juice is arrested by this state, but at the same time there is produced a considerable amount of tenacious alkaline mucus, containing large quantities of the morphological elements of the interior of the glands, which are generally

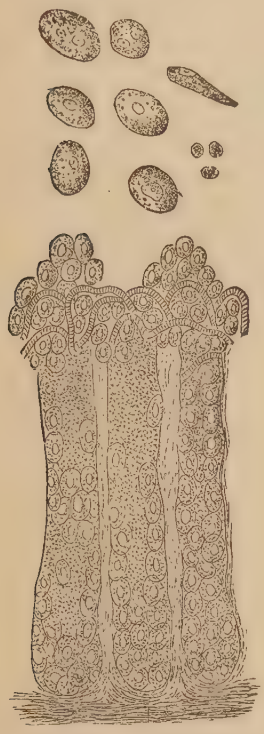
[1] *E. g.*, in the conjunctiva and in the skin after erysipelas. Andral, Clin. Méd. ii. 177. Congestion of the stomach to an amount sufficient to cause hæmatemesis may leave no traces after death. The bronchi are almost the only exceptions to this rule; but then it should be remembered that extensive bronchitis is almost always attended with congestion of the lung, which prevents the blood escaping by the pulmonary veins, into which those of the bronchi open. The fading of color is probably due to the contractile tissue accompanying the capillaries, but in the stomach it is always owing to post-mortem imbibition, and to the effects of the gastric juice. For further confirmation of this opinion the author ventures to refer to a previous work, "Diagnosis and Treatment of Dyspepsia," 2d ed. pp. 174, 175.

[2] From many of these, as in the cases of arsenic, tartar emetic, and cyanide of potassium taken in large doses, hyperæmia is almost constantly present; but from others, as from phosphorus (Virchow, "Der Zustand der Magen bei Phosphor Vergiftung," Archiv, xxxi. p. 399), it may be absent, and yet other signs of inflammatory action, presently to be noticed, may exist to a marked degree.

[1] A case of this kind is recorded by Guersant, art. "Gastrite," Dict. Sciences Méd. xvii. 576, where a young lady died after long-continued vomiting, together with fever and abdominal pain. The mucous membrane was covered with a tenacious mucus, the glands were prominent, and the membrane thickened and moist. The membrane was *whiter than in the natural state, and of the color of lard.* The vessels on the external surface were gorged with blood. The other organs were healthy. Guersant, not recognizing the inflammatory characters of this affection of the stomach, speaks of the disease as one *incertæ sedis.* Carswell, Illust. Elem. Forms of Disease, recognized the occasional *pallor* of inflammatory softening of the stomach.

separate, but sometimes adhere in masses, and then resemble the casts of the tubes excreted in similar conditions from the kidney.[1]

Fig. 2.

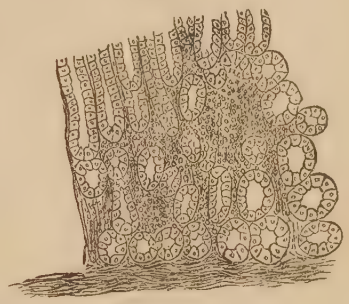


Glands and epithelial cells and free nuclei in a case of acute catarrh. The cells and nuclei are swollen and granular. The glands are irregularly distended, and contain a quantity of granular matter free. Enlarged capillaries are seen ramifying at the surface of the membrane.

The softening of the mucous membrane which accompanies these changes is totally distinct from the post-mortem softenings, which are distinguished by the transparency of the tissue. It rarely exists to any marked degree, except in extreme cases, but there is always a certain diminution of resistance to the finger-nail or to the scalpel, which materially assists, when conjoined with opacity and thickening, in distinguishing this condition. Louis' test of the extent to which it can be torn from the submucous tissue is a less available one, and applies rather to states of post-mortem solution than to this condition.

Coincidently with these changes there is a considerable increase in size if not in number of the solitary and lenticular glands, which then appear as small white specks, varying in size from that of a poppy to a millet-seed, thickly scattered over the surface. They are most abundant in the pyloric portion of the stomach and also in the duodenum. A considerable thickening of the interstitial tissue simultaneously occurs, owing to its becoming infiltrated with cell-structures similar to the "lymphatic" elements existing throughout the intestine.[1] They are imbedded in an alveolar network, but are not separated by any distinct line of demarcation from the tubular structures around, which are sometimes widely separated, and more or less obscured by this growth; and these changes greatly increase both the density and the thickening of the mucous membrane.

Fig. 3.



Interstitial growth of lymphatic elements between gland-tubes.

In some cases these structures ulcerate, and it is to this cause that the majority of the so-called follicular ulcers appear to be due. These form little cup-shaped depressions scattered more or less thickly over the surface of the mucous membrane, rarely exceeding at the surface a diameter of two or three lines, and seldom extending deeper than the submucous tissue. Their base is found to rest on a tissue infiltrated with lymphatic cells and with the granular débris of these, which may be generally also noticed for some distance in the surrounding tissue.

Other ulcerations, which are of the na-

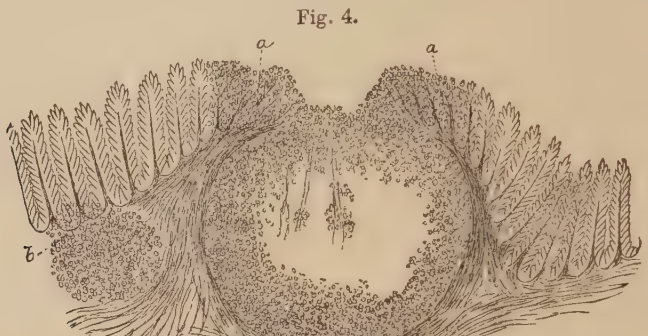
[1] Described by Dr. Cayley, Beale's Archives, i. 198; also by Dr. Fenwick, loc. cit. in scarlatina. I have seen them in the catarrhal affection of the stomach in diphtheria, and also in catarrhal affections of the intestines. They are less frequent either in the stomach or intestines in cholera.

For further descriptions of these appearances see a paper by the author, Med.-Chir. Trans. vol. xli. and Dyspepsia before quoted; also Dr. Schlaepfer, in Virchow's Archiv, vol. viii.; also Dr. Fenwick, Med.-Chir. Trans. xlvii.; also Virchow, in his Archiv, vol. xxxi., and Grohé, Ib. xxxiii.

[1] His, Untersuchungen über den Bau der Peyerschen Drüsen und der Darm Schleimhaut; Frey, Untersuchungen über die Lymphgefässe des Darm-kanals. (Leipzig, 1863.)

ture of erosions, are not uncommon. They are more superficial, but they may attain the diameter of a fourpenny piece. Their edges are often sharply defined, but there is very little thickening around them; I have never seen them extending for any depth into the tissue, and they rarely involve the whole depth of the secreting glands. They appear to arise from a superficial epithelial erosion, sometimes extending rather more deeply into the tissue, and resulting probably from the

Fig. 4.



"Solitary Gland," reaching surface and commencing ulceration (a, a). Infiltration of lymphatic elements among gland-tubes. At (b) is a mass of lymphatic elements in the submucous tissue beneath the bases of the tubular glands.

process described by Beaumont as "stripping and rolling up of the membrane." Early stages of this condition are sometimes found, when in circumscribed patches, giving evidence of acuter inflammatory action, the mucous membrane is found to be superficially reduced to a pulpy débris, the separation of which would probably have led to a similar result.[1]

In cases of a severe type, or when the affection of the stomach complicates septic or gangrenous inflammations in other parts, sloughs[2] may form on the mucous membrane, which may have a diameter of from a half to a quarter of an inch, but I have rarely seen them proceed to any depth.

Smaller solutions of continuity may also arise from extravasations of blood, ending in superficial hemorrhagic erosions. These are, however, much more frequently the result of mechanical congestion than of acute inflammation.

Exudative inflammations on the surface of the stomach seem also to be rare; I have once or twice seen them in phthisis, and Sir W. Jenner has observed them in diphtheria, and Rayer[3] says that they have been noticed in cases of croup. Pain and vomiting have been observed in some of these cases, but no special symptoms seem to be attached to this condition enabling a diagnosis to be made.

Another and still rarer affection is that corresponding to the gastritis phlegmonodea of Cullen, which does not as yet appear to have been recognized during life, and which can hardly be included among the class of diseases which have now been described.

The leading symptoms have been acute pain in the præcordial region, together with vomiting, violent fever, and delirium,[1] ending speedily in death.

In cases recorded by Wallmann and Bamberger, the affection of the stomach appears to have been idiopathic, and to have been the only lesion present; but in two others, which occurred in the practice of Oppolzer,[2] it commenced with puerperal fever.

In these instances the chief anatomical character has been suppuration in the submucous tissues of variable extent, sometimes undermining the whole membrane, or perforating it in various places. Bamberger says that the abscesses thus formed may perforate other organs to which the stomach has formed adhesions, but the rarity of these affections renders

[1] See Andral, Clin. Méd. ii. Obs. iv. p. 19.

[2] I am referring to instances entirely independent of corrosive poisons. I have seen them in gangrenous pneumonia, and similar cases are recorded by Recklinghausen (Virch. Arch. xxx.) and by Klebs (Ib. xxxii.).

[3] Dict. de Méd. x. 124.

[1] Bamberger, loc. cit. p. 260. Wallmann, Wiener Allg. Med. Zeit. Decr. 1856.

[2] Wiener Med. Woch. 1851, quoted by Bamberger. They are also described by Rokitanski; by Engel, Lehrbuch Path. Anat.; by Andral, Prec. Path. Anat. ii.; by Albers, Erläuterungen; Dittrich, Canstatt, 1857, iii. 179; Habershon, Guy's Hosp. Rep. 3d Series, ii. 115.

them the objects of pathological, rather than of clinical interest.[1]

Special descriptions of the appearances produced by the different kinds of poisons belong rather to the questions of medical jurisprudence than to the clinical pathology of the stomach. They will not, therefore, be described in this place.

DIAGNOSIS.—The acuter inflammatory disorders of the stomach are usually recognized without difficulty. Some of the severer forms may occasionally be simulated by the neuroses, but the chief points of distinction have been already alluded to.

The slighter forms, especially when occurring in the course of other chronic diseases, and particularly in phthisis, are more liable to be overlooked, the increased prostration and loss of appetite being too frequently referred to the effects of the general disorder. In such cases, symptoms of digestion of food are not always prominent, and the most valuable indication of the nature of the disease is to be derived from the appearance of the tongue, which, instead of being pale, broad, and flabby, as in the atonic state, becomes under these circumstances covered with a milky fur of more or less thickness, through which red papillæ appear. Thirst and constipation are often superadded.

The diagnosis of the febrile forms from typhoid is also often difficult; and sometimes doubt must continue to exist until after the appearance of the characteristic eruption of the latter. Points which may serve to assist in the diagnosis of the earlier stages are the swelling of the spleen in typhoid, together with tenderness or gurgling in the iliac fossa. The skin also is more frequently dry in typhoid, whereas in gastric catarrh perspirations are common. The temperature also is less elevated in the latter than in the former disease. Herpetic eruptions on the lips or elsewhere, which are common in gastric derangement, are very rare in typhoid. (Niemeyer, loc. cit.)

TREATMENT.—The primary indication in the treatment of recent inflammatory affections of the stomach, is to secure for the organ as complete a rest as it is possible to obtain; and, in the milder forms, a tolerably complete abstinence from food for four-and-twenty hours will frequently do much towards effecting a cure. In severer cases, and where the disorder is more protracted, or when the patient is too weak to bear abstinence, as in the case of infants, much may be effected by nutrient enemata in sparing the stomach, and allowing it the necessary repose. Such food as is taken should, when the disorder is of any severity, be restricted to milk and lime-water, or milk and soda-water, administered in small quantities every two or three hours. In cases where milk disagrees, as it does with some patients, veal or chicken broth, or beef-tea, in small quantities, may be substituted for it. [Instead of drinking much water to quench thirst, ice in small pieces may be taken.—H.]

In the case of infants suckling, the quality of the milk should be carefully examined, and, if the nurse is menstruating, a change is absolutely necessary. If obtained from the cow, the diet of the animal should be restricted to hay or fresh grass. In severe cases it is desirable that the child should be withdrawn from the breast for some hours, and a small quantity of rice-water, or of milk, greatly diluted, should be given at intervals. In the case of infants brought up by hand, the milk is to be largely diluted, and the addition of lime-water or of carbonate of soda is very desirable. When cow's milk absolutely disagrees, a change to ass's milk is sometimes sufficient to effect a cure; but this is not always the case, and medicinal treatment is often further necessary. A small quantity of farinaceous food, as arrowroot, sago, or gruel, may often be given with advantage with the milk; it appears to act beneficially by preventing the coagulation of the casein into lumps in the stomach.

In cases of less severity, in older children or adults, the lighter farinaceous puddings may be allowed. Solid animal food is decidedly to be prohibited as long as any nausea or pain at the epigastrium is caused by food entering the stomach; and when the needful rest of body is enjoined, this enforced abstinence may often be protracted during some days with decidedly beneficial effects. The return to a more nourishing diet is always to be effected gradually and with caution. As the symptoms subside, the patient may be allowed a small quantity of fish, or minced chicken, eaten with bread, but without (at first) any vegetables, and he may gradually proceed to game, or tender mutton, taken once in the day; but it must be remembered that any indiscretion or excess in diet is very likely to bring on a relapse.

Alcoholic fluids are decidedly to be avoided except where great prostration is present. When a stimulant appears to be urgently required, brandy is usually the best form in which it can be given; and in the case of children, and even infants, it may sometimes be advantageously administered, properly diluted, or combined with beef-tea or milk, by the rectum. Champagne also is occasionally found to be advantageous in checking vomiting;

[1] See collection of cases by Reynaud, Bull. Soc. Anat., Paris, 1861.

but it is less efficacious when this symptom is due to inflammatory action than when it arises from sympathetic irritation, or from the erethism of exhaustion.

Rest of body is equally essential, and in severer cases, and particularly when diarrhœa is present, the patient should be kept in bed until the more urgent symptoms have subsided.

General bleeding is decidedly inadmissible, as the disease ordinarily tends to produce considerable prostration, and any large loss of blood is likely to entail serious consequences, and to retard the recovery of the patient. When pain is continuous, and appears to be unassociated with the presence of undigested food, but to be increased by the introduction of even small quantities of food into the stomach, leeches are often of service. They should not, however, be used in the case of children unless under *very* exceptional circumstances, and in weakly persons the number should be restricted to two or three. If there is evidence of much congestion of the liver, or if hæmorrhoids have been present, they may be applied to the anus; but usually they are best applied to the epigastric region.

Hot fomentations are of value; they should be applied continuously by means of flannel, spongio-piline, or linseed-meal poultices. Counter-irritation by mustard-poultices, or by friction with croton oil, or, in severe cases, with tartar emetic, may be occasionally resorted to with advantage. The warm bath is also frequently of decided service.

Emetics may be administered when the presence of undigested food in the stomach is indicated by cramp-like pain, nausea, ineffectual attempts to vomit, and faintness, but care is necessary in the use of these remedies; and the stronger agents of this class, and especially tartar emetic, or even mustard, are to be avoided (see *ante*), as they have been known to cause great aggravation of the symptoms. The best emetic is a scruple of ipecacuanha, and the emetic action may be aided by large draughts of lukewarm water, or of infusion of camomile; but if vomiting do not occur readily, it is undesirable to repeat the dose, a proceeding which may be followed by very injurious results. It must be remembered that the cramp-like pain originating in the stomach may continue in the intestines when the undigested food has passed into them; and further, as Bamberger has remarked, the effects and sensations attributed to the irritant may continue in the stomach in the same manner that the impression of the presence of a foreign body in the conjunctiva may persist long after its removal.[1]

For the condition known as "embarras gastrique," M. Martin Solon[1] has employed ipecacuanha in doses of six or seven grains, given three times in twenty-four hours. In most of his cases the medicine thus given produced bilious stools and vomiting; in several instances a single administration conducted in this manner accomplished the cure; and in others, when a repetition of the medicine was necessary, this was generally effected within three days. In a few cases the disorder was aggravated by this treatment, showing that it is only available within certain degrees of severity of the affection; but the presence of fever by no means contraindicated its use.

In the milder forms of the affection, even when of some standing,[2] the utility of purgatives is considerable, and has been recognized since the days of Hippocrates.[3] Their immediately beneficial effects were also plainly seen in several of Beaumont's observations,[4] when the redness and aphthous appearance of the stomach, accompanied by a loaded tongue, frontal headache, and sallowness of skin, were relieved by full doses of calomel and aloes.

The best remedies in these cases appear to be mercurials in purgative doses. In the case of an adult and vigorous patient, calomel may be advantageously given in doses of from three to eight grains, and followed after some hours by a draught composed of: magn. sulph. three drachms, magn. carb. two scruples, tinct. jalapæ half a drachm, in aq. menth. pip.; or by castor oil, or the haust. sennæ co., or the decoct. aloës comp. When such active effects are undesirable, the blue pill, with compound colocynth pill and ipecacuanha, often proves very serviceable, and it may be followed by a seidlitz draught, or by any other moderately purgative mixture. [Small doses of blue mass (one or two grains night and morning for a day or two) may be given without requiring any stronger cathartic than magnesia.—H.]

In the case of the acute indigestion of

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[1] That undigested food may, however, remain long in the stomach, and be the source of severe pain and discomfort, is shown by two cases related by Sir T. Watson, in one of which a mass of casein, and in another an accumulation of snuff, were vomited, after causing during several days severe gastric pain and disorder. (Lectures, ii. 440.)

[1] Gaz. Méd. de Paris, 1836, No. xvi. I have not resorted to this plan, as I believe, from my own experience, that an active purgation produces equally good effects with less discomfort to the patient.

[2] Andral, Clin. Méd. ii. 186.

[3] "Anorexia, heartburn, vertigo, and a bitter taste in the mouth of a person free from fever, indicate the want of purging upwards and downwards." (Aph. 17, lib. i. sec. iv. Syd. Soc. Trans.)

[4] See loc. cit. pp. 118, 182, 266.

children beyond the period of infancy, when there is fever and griping, or even when the latter is absent, a dose of calomel and scammony, or of hyd. cum. cretâ with rhubarb, followed by castor oil, sometimes proves beneficial; but children in this complaint bear purging less than adults, and frequently a dose of castor oil will, if followed for a day or two by suitable care in diet, perform all the service that can be obtained from this class of remedies.

In severer cases, where there is much irritability of stomach together with frequent vomiting and pain, purgatives by the mouth should be avoided, and they are generally inadmissible when diarrhœa is present, unless there is reason to suspect that undigested food is still retained in the intestines; and the action of the bowels may be procured, if this appears necessary, by aperient enemata.

In rarer instances, when much constipation has preceded or attended the attack, and when vomiting is severe and troublesome, calomel in half-grain doses frequently repeated has been found useful in checking the latter symptom; and a similar indication has been fulfilled by the use of the mixt. magn. sulph. cum magn. carb., repeated at intervals until the bowels have acted freely. Purgatives are also the most efficient immediate remedies for the relief of the sick headache, though the state of the digestion in which they originate often requires careful attention. Mercurial or saline purgatives are the most efficient in their action, but the activity of the doses should be proportioned to the strength of the patient. Dr. Wood recommends in severe cases the combination of sulphate of magnesia with morphia.

[Sick headache may often be relieved by the early use of a laxative dose of magnesia, to which are added fifteen or twenty drops of aromatic spirit of ammonia. Periodical cases, however, and some others, in which the nervous element of the attack seems to be paramount, will be less easy to abridge or mitigate. I have tried quinine, perseveringly, in some such cases, without much encouragement in the results obtained. Other remedies which are at times successful are, guarana, 10 to 15 grains at once; oil of turpentine (W. Begbie) in moderate doses; citrate of caffein, 4 to 8 grains at a time; and the application (Kennion) of solution of bisulphide of carbon for a short time to the temples or behind the ears.—H.]

With these exceptions, it is always undesirable to continue the repeated exhibition of purgatives, the effect of which is likely to prove as injurious as a single dose is beneficial, and is liable not only to aggravate the stomach disorder, but to cause an extension of the complaint to the mucous membrane of the duodenum and intestines, if these have not already suffered. Some caution is also necessary in the earlier stages of the febrile forms of the disorder, lest a case of typhoid should be mistaken for one of simple gastric disorder, and serious consequences be entailed on the patient by the administration of a class of remedies which, in the former complaint, must always be regarded as sources of extreme danger.

After the administration of emetics and purgatives, and in the severer cases when these are inadmissible, our main reliance must be placed on sedatives and antacids.

One of the most valuable of the former of these is cold, though it is rarely, if ever, advisable to employ it externally; but sucking small pieces of ice often affords great relief to the uneasiness of the stomach and to the vomiting. Thirst may also be quenched in this manner; but the desire of the patient to drink largely is to be restricted, as distension of the stomach is liable to maintain the tendency to vomiting.

When the vomiting is severe, opium may be administered in full doses with advantage. It is, however, more useful in the severer than in the milder forms of the disorder; and in the latter, which are more appropriately treated by purgatives, salines, and antacids, it is seldom beneficial, and sometimes even proves the reverse.

Hydrocyanic acid is of inferior advantage in checking vomiting in this disorder, but it may be given with occasional benefit in effervescing draughts, containing an excess of alkali.

Bismuth, either in the form of the trisnitrate or subcarbonate, has a peculiarly favorable effect in all the milder forms of inflammatory action; and I have found it more beneficial than any other remedy in the gastro-intestinal catarrh of children. The bismuth should be given in doses of from three to five grains to children, and from ten to twenty grains to an adult; it may be combined with magnesia or hydrocyanic acid, or, when pain or diarrhœa is present, with morphia or tinct. opii.

Carbonic acid is also a valuable agent in relieving pain and vomiting. The mode of its administration has been already alluded to.

In milder cases Vichy, or Seltzer, or soda-water forms a very valuable mode of administering antacids and salines; of the former, which is particularly useful in the latter stages of subacute inflammatory attacks, a pint, or a pint and a half, may be taken daily between the meals. The beneficial action of the alkalies is in these cases due in part to their effect in neutralizing the acidity resulting from fermentative changes caused in the food by the unhealthy secretions of the stomach, but I think it probable that some share in their efficacy is also attributable to their direct action on the mucous mem-

brane. Bamberger speaks highly of the value of muriate of ammonia in cases where the disorder threatens to become chronic.

As a general summary of the treatment it may be stated that in the milder forms of the disease one or two doses of a brisk mercurial cathartic, followed by antacids, magnesia, bismuth, Vichy or Seltzer water, and a careful restriction in diet during the attack, will usually bring the disorder to a termination in three or four days. In the severer cases, when pain is felt after food, and vomiting is troublesome, purgatives and emetics are contraindicated; and repose as absolute as can be obtained for the patient and for the organ, together with opium, ice internally, or small quantities of effervescent drinks, and leeching, fomentations, or counter-irritation to the epigastrium, are the indications principally to be relied on for obtaining a cure.

A weakened state of the digestion, entailing a liability to fresh attacks, often continues after the acuter symptoms have subsided; it is attended with a feeling of languor and of inability for active exertion, and not unfrequently with flatulence or occasional heartburn, or with some other of the symptoms of atonic dyspepsia. This state requires great care in treatment, and the use of the so-called bitter tonics demands especial caution, as their untimely use will often perpetuate a chronic form of subacute inflammatory action.

The general rules laid down for the treatment of atonic dyspepsia are those most applicable in these cases; and attention to diet is to be pursued with additional caution, which is to be especially extended to vegetables and fruit. Exercise should be moderate, and should not be pushed beyond a degree sufficient to cause a slight and healthy feeling of fatigue. Chills should be carefully avoided; for patients in this condition are as liable to "take cold" in the stomach as others, in whom the respiratory system is weakened, are to attacks of bronchitis. Alcoholic stimulants are only to be used in great moderation—dry sherry (the Manzanilla or Amontillado being the best), or weak brandy and water, or claret and water, are the most suitable forms for their administration; malt liquors, and also the use of coffee, are to be decidedly forbidden. If all signs of irritation have disappeared, while those of atony continue, and if the deficiency in the appetite indicates the use of bitters, calumba and nux vomica are those most applicable; these may generally be advantageously combined with the mineral acids, and should be given immediately before food is taken.

Pepsine, also, often proves very serviceable at this stage.

If anæmia be present, the milder ferruginous preparations are to be employed in the manner indicated under the head of Atonic Dyspepsia.

Care and patience are at all times necessary in cases of this description. The tendency is to a cure, if it be not interfered with by undue haste on the part of the patient to regain strength, by taking food in excess of the digestive powers of the stomach, or by the use of stimulants beyond a degree which the weakened tissues are able to support without their normal action being perverted to inflammatory irritation.

Purgatives, which the sluggish condition of the bowels may sometimes appear to render necessary, are also to be used with great care. Aloes is usually the best form that can be selected; but the use of enemata is to be preferred. In children, small doses of rhubarb and soda, or of the domestic Gregory's powder, are often decidedly advantageous; or friction with aloes may be employed on the surface of the abdomen.

In infants, small quantities of magnesia will often answer all indications in this respect; but in them the tendency to diarrhœa is more marked than in adults, and purgatives are seldom necessary.

In older children and in adults, the action of the bowels is often facilitated, and irritability of the gastro-intestinal membrane greatly relieved, by wearing over the abdomen, either during the day or night, a compress wrung out of warm or cold water, and protected by a piece of mackintosh. It should be changed three or four times in the twenty-four hours.

Change of air and scene, as spoken of under the head of Atonic Dyspepsia, is sometimes necessary in weakly patients to complete a cure.

[For *Cholera Morbus*, see the latter part of this volume.—H.]

V. Chronic Gastritis—Chronic Catarrh of the Stomach.

Synonyms.—Chronic Inflammatory Dyspepsia, Morbid Sensibility of the Stomach (Johnson); Gastrite Chronique Fr.; Chronisches Magen Catarrh, Germ.

Definition.—A disorder of digestion, the symptoms of which consist in the imperfect assimilation of food, associated with physical and moral depression, with irregular appetite, thirst, and slight degrees of pyrexia, and with impairment of the general nutrition, attended in some cases by gastric pain, by the vomiting of mucus, and by various alterations in the urine, and which depend on chronic inflammatory conditions of the stomach, revealed by congestion, pigmentation, and

thickening of the mucous membrane, and by atrophy and degeneration of its secretory glands.

This disease embraces a large number of the cases of obstinate chronic dyspepsia, and includes, in the author's opinion, many of the disorders which have been described as irritative dyspepsia, and even some which have been ranked among the nervous disorders, and especially those forms which have been regarded as resulting from "morbid sensibility"—a condition which in mucous tissues is much more commonly the result of minor degrees of inflammatory action than of mere derangements of innervation. Confusion has also been introduced into the nosology of this disorder by the inclusion under this title of cases of ulcer and cancer,[1] and especially of the former.

THE ETIOLOGY of this affection is somewhat complex, since the disorder may either exist *ab origine* in a subacute form, perpetuated by the persistence of its exciting causes, or may remain as an effect of an acute attack, which has weakened the nutrition of the mucous membrane, and has thus induced a liability to minor degrees of inflammatory action from slight causes. It is therefore difficult logically to define in all cases the limits between the predisposing and the exciting causes, since many of each class act apparently in both directions.

The disease appears to be to a certain degree hereditary, but no special etiological influences can be attributed either to sex or age, as it is common at all periods of life.

The impaired condition of the digestive powers which has been described under the head of Atonic Dyspepsia, induces liability to inflammatory disorders of the stomach, and hence the causes of this state may all act as indirect predisposing causes of the irritative forms, both of the acute and of the chronic kind.

Among the other constitutional diseases which appear to involve a special liability to this affection—though often acting apparently in diverse manners—may be mentioned scrofula, phthisis, gout, albuminuria, and diseases tending to disturb the portal or abdominal circulation, such as emphysema, heart disease, and, *à fortiori*, cirrhosis of the liver, or other conditions affecting the circulation through this organ. The following table exhibits the principal diseases with which I have found either acute or chronic catarrh in 100 stomachs examined:—

Acute Catarrh.	No. of cases.	Chronic Catarrh.	No of cases.	Acute and Chronic Catarrh combined.	No. of cases.
Pneumonia Acute	2	Tubercle of Lungs (uncomplicated)	4	Tubercle of Lungs (uncomplicated)	2
Chronic	1	Tubercle of Lungs, Tubercular Peritonitis	1	Tubercle of Lungs, Morbus Cordis	1
Variola	2	Tubercle of Lungs and Intestines, Bronchi-Ectasis, Morbus Cordis	1	Tubercle of Lungs, Tubercular Pericarditis, old Valvular Disease of Heart, Liver Fatty, Kidneys Granular	1
Puerperal Peritonitis, with recent Bright's Disease	2	Tubercle of Lungs and Intestines, Liver Fatty	1	Tubercle of Lungs, recent Bright's Disease	1
Perimetritis Puerpera, with recent Bright's Disease	1	Tubercle of Lungs, Morbus Cordis, Granular degeneration of Kidneys	1	Morbus Cordis	2
Phlebitis, from various causes associated with first stage of Bright's Disease	2	Tubercle of Lungs, Morbus Cordis	1	Morbus Cordis, Cirrhosis of Liver, recent Pneumonia	1
Endo-Pericarditis, 1st stage of Bright's Disease	1	Capillary Bronchitis, Morbus Cordis	1	Pneumonia (uncomplicated)	1
Suppurative Parotitis	1	Chronic Bright's Disease, Fatty Liver	2	Pneumonia, Phlebitis	1
Cholera: Kidneys in 1st stage of Bright's Disease	2	Morbus Cordis, Gangræna Pulmonum	1	Morbus Cordis, Gangrene of Lung	1
Typhoid Fever	1	Morbus Cordis, Caries of Pelvic Bones	1	Pneumonia, recent Bright's Disease	1
Morbus Cordis	1	Melanosis of Lung, Pleurisy	1	Puerperal Fever	1
Morbus Cordis, Capillary Bronchitis	1	Cystic Disease of Ovaries, Peritonitis	1	Typhoid Fever	1
Tubercle of Lungs	1	Abscess in Œsophagus	1	Delirium Tremens	1
Tubercle of Lungs and Tubercular Peritonitis	1	Hernia	1	Cirrhosis of Liver	1
Diabetes	1	Drunkard. Other pathological conditions not noted	1	Suppurative Parotitis, Kidneys Fatty	1
Carcinoma Ventriculi	1				
Total	21	Total	19	Total	17

[1] Cf. Audral, Clin. Méd.

One remarkable fact which appears from this table, especially in the contrast between cases of recent and chronic catarrh, is the greater proportionate frequency with which the former is associated with acute, and the latter with chronic, inflammatory, affections of other organs; and it would seem as if the same exciting cause not unfrequently sufficed to produce similar changes in the ultimate structures of many organs simultaneously.

The tendency of diseases obstructing the venous circulation to induce chronic catarrhal conditions of the stomach is also well illustrated in this table; but the remarkable frequency with which they are associated with phthisis is especially apparent, having been present in 28 per cent. of the whole number, or in sixteen out of thirty-one, or nearly one-half, of the tubercular cases examined.[1]

Of the more direct exciting causes, among the most frequent must be placed either an habitual excess in eating, or a constant use of food that disagrees; especially by persons whose general health and digestive power are below the healthy standard; by this means a series of minor attacks of indigestion of an irritative type are excited, which at times alternate with acuter forms of "embarras gastrique," from which such patients are continually liable to suffer.[2] It cannot be too strongly insisted on, that the tendency of undigested food is always to give rise to gastro-intestinal irritation, whether the cause of the indigestion reside in the stomach, or in the quality or excessive amount of the food or drink, or in some of the other accidental conditions mentioned among the general causes of dyspepsia—of these deficient insalivation or imperfect mastication, or the habits of mental or physical work after meals, are among the most frequent.

The habitual use of spirits, particularly when undiluted, or when taken to any amount that can be considered excessive, is also an almost unfailing cause, when long continued, of chronic inflammatory changes in the stomach; and it is seldom in cases of this nature that some of the post-mortem changes hereafter to be mentioned cannot be discerned.[1]

Chronic or subacute catarrh of the stomach is also a very frequent accompaniment of cancer and ulcer of this organ, as well as of pyloric obstruction. The question of the mode of its causation in the two former of these diseases is one of no little difficulty, but it is probably to its agency that many of the derangements of digestion observed in their course are attributable.

Medicinal causes deserve also some consideration, and especially the abuse of stimulants and tonics or purgatives in many of the forms of atonic dyspepsia; nor can other remedies be absolved from the onus of having occasionally produced these effects, which have been attributed to the prolonged use of arsenic and bichloride of mercury, and occasionally of cubebs and copaiva.

There are some cases of syphilis recorded, accompanied by symptoms closely resembling those characterizing this group of diseases, and which have been cured by the administration of mercury. The evidence of their nature is incomplete, but, pending their complete elucidation, I am inclined to believe that, judging of the effects of this poison in other tissues, such disorders are most suitably classified among the inflammatory affections of the stomach.

Lastly may be mentioned, mechanical irritants of all kinds.[2]

THE SYMPTOMS of this disorder are primarily those of indigestion of an aggravated kind, but they are often varied, and very irregular in their course; nor are they always united in one case, some being at times more prominent than others. It is of this class especially that the remark made with regard to the general symptoms of indigestion will be found to be true, that the condition may often

[1] The author's more recent observations, though not capable (from peculiar circumstances) of being framed statistically, have fully confirmed his opinion of the etiological influence in this direction of these classes of disease; and he has been increasingly struck with the frequency of the coexistence of the anatomical conditions to be described, as found in chronic catarrh, with cirrhosis of the liver and with granular conditions of the kidney, to which they bear the strongest resemblance. Dr. H. Jones's observations also give some support to this view, for, in twenty-three cases of catarrh of the stomach, he found tubercles in four and disease of the lungs in eleven more, while in eight there was disease of the kidneys, and in three disease of the heart.

[2] Broussais (Lec. Phleg. Gastriques, p. 183) says that the causes which in adult age perpetuate a chronic irritation would, in the earlier periods of life, have produced an acute attack.

[1] The average ratio, in persons who have indulged in these excesses, of deaths from the digestive organs (including disease of the liver) to deaths from all causes, according to Neison's researches, amounts to 12·47. ("Vital Statistics," quoted by Parkes on Hygiène, p. 299.) I believe that the amount of injury to the stomach is much underrated, since changes in this organ often escape observation, and are rarely directly the cause of death.

[2] See a case of pins swallowed by an hysterical woman. (John Marshall, Med.-Chir. Trans. xxxv.)

be revealed by the general state of the system, or by impairment in the functions of some other organs, rather than by symptoms appreciable by the patient himself, as truly proceeding from the deranged stomach.

In many cases there are at times intervals of almost complete immunity from apparent dyspepsia, but these are seldom complete, and are speedily followed, often with no apparent cause, by returns of the old symptoms, and with exacerbations of an acuter kind, after the slightest indiscretion in diet; and this irregularity is of no small value in distinguishing the nature of the complaint, having its parallel in most of the chronic inflammatory affections of other mucous membranes.

Those referable to the stomach are a sense of weight, oppression,[1] distress, or undefined uneasiness of the epigastrium, ensuing after meals, and often associated with distension from flatulence, which sometimes may be very considerable; a sense of tightness and constriction at the sternum, or a feeling of fulness in the pharynx and œsophagus; and in other cases an uneasy, ill-defined sensation of discomfort is felt in the dorsal region between the scapulæ, though rarely also in this situation amounting to the acuter pain met with in ulcer and cancer. The sensations complained of generally commence within half an hour to an hour after taking food, and continue more or less during the whole period of digestion. Other discomforts follow at a later period, such as intestinal flatulence, and borborygmi, together with an increased sense of distension and oppression, especially felt in the right hypochondriac region. Sometimes these uneasy sensations, when accompanied by acidity, are relieved by taking more food, but this alleviation is frequently only temporary, and is followed by an increase of the original discomfort.

The ingestion of food is rarely, if ever, a cause of immediate pain; and this is not, indeed, a prominent or (with any severity) a frequent symptom, though it may occasionally arise if much mucus is secreted, or when flatulence is present.

Tenderness on pressure is not usually a marked symptom, though some degree of it often exists. Heartburn and acidity are often very annoying, but they are by no means constant. [The late Dr. G. B. Wood dwelt with emphasis upon epigastric tenderness as a diagnostic sign between Chronic Gastritis and atonic dyspepsia.—H.]

Nausea, to a certain degree, is not unfrequent, but it is seldom distinctly felt; and vomiting is rare, except in certain special forms, associated with either albuminuria, congestion, the dyspepsia from drink, and occasionally with phthisis.

The appetite presents considerable variations. It is capricious, and generally it is diminished, though not as a rule, to a marked degree. Eating is, however, soon followed by a sense of satiety; and the feeling of discomfort and fulness at the stomach which often ensues, even during a meal, serves at once to check the desire for food; though if this be neglected, and a full meal taken, the symptoms are usually increased in severity. In other instances there is the same sense of sinking, and of craving for food, which is observed in some of the neuroses, and which must in these cases be considered as a perverted sensation arising from the condition of gastric irritation; though it should be borne in mind that nervous erethism may at times complicate this complaint, and introduce much complexity among the symptoms observed.

Thirst is a very prominent and distinctive symptom, and it is hardly ever absent in cases of inflammatory irritation of the stomach, whether this be acute or chronic. It exists during meals, but is most marked in the intervals, when the patients have an extreme craving for fluid; and this is particularly felt in the evening, if the chief meal has been a late dinner. The feeling is not only one of thirst, but a sense of languor, oppression, exhaustion, or internal heat is often combined with it, which is relieved by drinking, and especially by cold fluids; but in some cases even these give distress, and warm drinks, especially tea, are eagerly taken, though often in the latter case only to be followed by increased discomfort, acidity and flatulence.

The breath is often heavy and offensive. There is very frequently a bad taste in the mouth, which is ordinarily most marked on first rising in the morning. The gums are spongy, red, swollen, often retracted from the teeth, and inclined to bleed, and the saliva and buccal mucus are occasionally acid. An excessive flow of saliva is not uncommon, and is particularly observable at night, when it may escape from the mouth during sleep, wetting the pillow. The lips tend to become dry and cracked, and the fauces are liable to erythematous inflammation, with slight superficial ulcerations. The pharynx also may be the seat of a granular inflammation, associated with excessive secretion of a tenacious mucus, which is a source of great annoyance and discomfort to the patient.

The conditions of the tongue present some variations; but as these are valuable aids to diagnosis, they deserve to be especially dwelt upon.

(*a*) If associated with distinct atony, the

[1] *Barre* of the French writers, described "as if a bar were pressed across the epigastrium, or base of the chest."

tongue may be broad, somewhat pale, and flabby, but the papillæ generally are enlarged—this being most apparent in the fungiform papillæ on the tip and edges, which are also redder than natural, and there is a thin white fur over the surface. Sometimes, however, this fur may be present when the papillæ, though enlarged, are pale.

(*b*) In the more distinctly irritative forms, and especially in children who have any signs of scrofula, and in phthisical adults, the whole organ is redder than natural, and may be of a bright florid color, and even raw-looking; it is often pointed at the tip, which together with the sides, presents an extreme degree of injection, and the papillæ stand out as vivid red points. There may be at the same time a coating of variable thickness along the dorsum. This form is frequently associated with aphthæ, especially at the tip, and sometimes on the inside of the lips; or with painful spots on the tongue, which are found on close examination to be papillæ slightly abraded.

(*c*) In older persons, and particularly in those in whom the dyspepsia is the result of excessive or hurried eating, the tongue, while presenting some degree of enlargement and redness of the papillæ at the tip and edges, is often uniformly covered throughout the greater part of its extent with a thicker fur, sometimes whitish, and occasionally of a browner tint, which more resembles the coating attending the acuter attacks, and which patients recognize as a symptom of "biliousness."

(*d*) Lastly, it must be mentioned, that in cases which I cannot but regard, as far as my experience extends, as being exceptional, though more common where the catarrh of the stomach is secondary to local causes of congestion from venous obstruction, the tongue may present very little deviation from the natural condition, though occasionally, even in these, transitory formations of a white fur on the dorsum may be observed on repeated examinations.

Some of the intestinal symptoms have been already alluded to. In addition, it must, however, be noted, that constipation is often obstinate; it is frequently associated with much uneasiness in the rectum, and it greatly increases the general feelings of oppression, malaise, and languor. The stools may be dry and scybalous, and are not unfrequently coated with a considerable amount of tenacious mucus, which may form casts of portions of the intestinal canal. Occasionally they are passed with tenesmus and straining; sometimes they present thin flattened bands; and they are usually accompanied or preceded by the escape of flatus. They are generally pale, both in this state and in another occasionally met with, when the constipation is less marked, and when one or two large, pultaceous, often offensive, and sometimes frothy motions, containing considerable quantities of undigested food, are passed in the day—when there are often griping pains in the abdomen, and a liability to severer attacks of colic. In other cases the two conditions alternate, or slight causes may give rise to transitory attacks of diarrhœa, which may afford temporary relief, but are commonly followed by an aggravation of the intestinal flatulence and of the general discomfort, and are often attended with increased signs of irritation on the tongue and with the production of aphthæ, as before described.

Piles are a not uncommon complication of this state, even when evident disease of the liver is absent.

The cutaneous surface shows various indications of the perverted general nutrition of the body. It is often dry and harsh, sallow, earthy, and wrinkled; and at times, after slight indiscretions of diet or without assignable cause, patients are liable to suffer from eczematous or impetiginous eruptions, which may be followed by a perceptible alleviation of the symptoms.[1] Children are more liable to suffer from these, and occasionally from hepatic eruptions, than adults; but gouty patients, and those who drink excessively of malt liquors, are occasionally subject to them. A vinous tint on the malar bones and nose is also by some writers attributed to the disturbance of the stomach.[2]

The hair tends to become dry, harsh, and prematurely gray; sometimes it is lost in considerable quantities when acuter exacerbations supervene. The nails are often furrowed, and have a tendency to split. In children who suffer much from irritative dyspepsia during the

[1] A case of this kind lately came under my notice, of a young lady whose father is liable to gout, and who had for years been liable to an aggravated form of irritable dyspepsia, but whose symptoms almost entirely disappeared for many months since the eruptions of an eczematous rash on her face. Trousseau (Clin. Méd. ii. 1862, p. 280) has noticed that in dyspeptic patients who resort to seabathing a febrile condition, followed by urticaria, frequently results, and that the eruption on the skin is followed by a great relief to the symptoms of the stomach. Allusion has been already made to the occasional concurrence of this disorder with some of the forms of acute indigestion, and a somewhat similar instance is also mentioned by Schmidtmann (loc. cit. iii. 225): "Novi mulierem in qua herpes faciei cum cardialgia alternabat; extante in facie herpete a cardialgia vacabat; eo disparente, extemplo duris torquebatur ventriculi doloribus."

[2] Rayer, Dict. de Méd. x. 156; Chomel, ib. x. 92.

second dentition, the teeth are often irregular, with thin enamel, and are crenated at the edge, while the anterior and, to a less degree, the posterior surfaces are marked by vertical depressions or sulci.[1] In adults the teeth suffer from premature caries, often erroneously attributed to the use of mineral acids given for the cure of the complaint, but more commonly due to impaired general nutrition, and especially to the spongy condition of the gums and to their retraction above the enamel.

Emaciation is almost constantly observed when this disorder has persisted for any length of time, though it is not early in its appearance, unless the patient has been previously out of health, or the disease is severe; but a gradual loss of flesh and strength is an almost constant symptom, and one that should, in the absence of other signs of disease, cause a special attention to be directed to the state of the digestive organs.

Coldness of the extremities is a very common symptom, and it is not unfrequently attended with flushing of the face and oppression of the head. Patients of this class are almost always chilly. They are liable to slight rigors and to suffer much from changes of temperature, which are often followed by an aggravation of their sufferings.

Febrile reaction of a slight type, preceded by rigor and malaise, is very common. It often appears to be directly associated with the taking of food, or of alcoholic stimulants, but in other cases it seems to have a special tendency to exacerbation in the evening; sometimes returning with such regularity as to have given rise to the suspicion of a malarial cause, and to have led to the ineffectual use of quinine.[2] The skin becomes hot and dry, especially in the feet and hands; but in other cases these may be cold, while a great sense of heat is complained of in the trunk and head. It occasionally occurs at night, and then is often followed by copious perspirations during sleep.[3]

There may be at times an icteric tint of the conjunctivæ, but this is not observed with any considerable frequency. Slight attacks of ocular conjunctivitis, sometimes attended with phlyctenæ, are by no means uncommon.

Slight catarrhal affections of the air-passages are also not unfrequent. Those of the fauces and pharynx have been already alluded to; but the same condition may invade the larynx, giving rise in some cases to injection, with relaxation of the vocal cords, and thus causing dry cough, or hoarseness and huskiness of the voice; or the affection may extend deeper, and be the source of a muco-purulent secretion, which is often aggravated during the febrile accessions which occur after meals, and especially after wine has been taken, and may give rise to cough coming on at these periods.

Dyspnœa, and a desire to sigh, are very frequently complained of. They are sympathetic symptoms common to all forms of indigestion, but are very marked in the variety now under consideration.

A very interesting and important question connected with this subject is the connection of these disorders to the causation of phthisis.

By some authors disturbance of the digestion has been considered to be an immediate cause of the development of pulmonary tubercle; while by others the relation of the two conditions has been considered as accidental; or it has been held that the irritative dyspepsia so often observed in phthisis is secondary to the tuberculizing process in the lung.

It would appear, however, to the author that in cases where long-continued irritative dyspepsia has preceded disease of the lung, the latter has required for its production some other exciting or predisposing causes than the simple impairment of nutrition produced by the mal-assimilation of the food. In the majority of instances where they coexist, both the gastric and pulmonary disturbances have either appeared to be due to an unhealthy constitutional condition, and have been developed and advanced almost *pari passu*, each accession of pulmonary disorder with pyrexial disturbance being associated with a fresh attack of gastric catarrh, which has tended to become chronic; or the derangement in the stomach has been secondary to that in the lung, and caused either by pyrexial conditions, or by impairment of the general health, or possibly by reflex irritation.

The urine, in most of the chronic in-

[1] This condition of teeth is very common among children to whom "gray powder" has been administered at the time of the second dentition; but I have frequently observed it, independently of this cause, where there has been much dyspeptic disturbance at this period. In a third class of cases it is hereditary, appearing when the digestion is good; but it is not unfrequently associated with scrofula.

[2] Chomel, Des Dyspepsies, p. 79.

[3] It may be well here to recall the aphorism of Hippocrates in relation to the causation of many of these forms, which has been already alluded to: "A copious sweat after sleep, occurring without any manifest cause, indicates that the body is using too much food." (Aph. 41, sec. iv.)

[1] Wilson Philip, Mr. Hutchinson (Med. Times and Gazette, 1855). The dyspepsia preceding phthisis has been attributed by Dr. Hughes Bennett and Mr. Hutchinson to a dislike to and mal-assimilation of fatty substances.

flammatory affections of the stomach, is more constantly affected, in various ways, than in the other forms of disturbance of digestion before noted. The most common of the changes presented are the deposits of urates, earthy phosphates, and oxalates. None of them is peculiar to this form, and moreover urine of high specific gravity, and characterized by the deposit of urates, is almost invariable in the acuter stages of inflammatory dyspepsia.

Earthy phosphates, with urine sometimes of a high, and sometimes of a low, specific gravity, and often alkaline and cloudy on emission, are very common. The specific gravity depends, in some measure, on the amount of fluid taken with the meal preceding the period at which the urine is passed; and thus it is commonly low in the morning after breakfast, and generally higher in the evening, when the exertions of the day and the food taken have probably increased the amount of urea. By some authors this condition of cloudy, alkaline urine, which often becomes iridescent on standing, has been referred to duodenal indigestion,[1] this idea having probably arisen from the fact that this deposit in the urine frequently corresponds with the period at which the food passes into the intestines, and with the aggravation of the symptoms of malaise and flatulence which often occurs at that time. The author is inclined to believe that the alkalescence of the urine in these cases may be in part due to the defective secretion of the liver and pancreas; of the former of these we have evidence in the pale, clayey stools, and also some presumptive proof in the great increase of flatulence which occurs in the intestines. The fact that these deposits often alternate with urates, and sometimes with oxalates, lends a further support to this view; since the latter seem to be invariably associated with a faulty assimilation or metamorphosis of protein and saccharine matters,[2] and may probably depend on the abnormal condition in which these enter the blood after the imperfect intestinal digestion caused by the deficiency in supply of those secretions.

The deposit of urates is often associated with the febrile heat complained of after meals, but the same symptom has been noted in connection with both oxalic and phosphatic deposits.[3]

The nervous system participates markedly in the general disturbance.

Languor, lassitude, pains in the trunk and limbs—the latter sometimes dull and aching; sometimes, when in the scapular region, severe and lancinating; at others directly affecting the muscles, and simulating conditions of chronic rheumatism,—a feeling of inability for exertion, especially marked after meals, and often felt on rising in the morning, irritability or excitability of temper, intellectual depression, loss of judgment and of the reasoning powers, and of memory, characterize this state. Hypochondriasis occurs also more commonly in connection with this condition than with almost any other form of dyspepsia. Fear, timidity, anxiety; despondency to such a degree that, "in a merchant surrounded by affluence, apprehensions of impending beggary often embitter the moments that are free from the excitement of business; in the mechanic, unfounded ideas of immediate loss of employment, and visions of the interior of a workhouse, are generally present."[1]

Headache and a feeling of tension are frequently present; but the sick headache is not so common in advanced forms of the disease (unless under the supervention of acute attacks of indigestion), as in the simple atonic or acute forms; the feeling being generally rather one of fulness, or of dull pressure, in the occipital or frontal regions. Vertigo is occasionally met with, especially when irritation has supervened on the atonic form; but with this exception it is, comparatively speaking, rare in this variety.

The expression is anxious and careworn, and, in conjunction with the emaciation and sallow tint of skin so commonly present, gives to the individual a look of premature age.

Extreme degrees of sleeplessness are very common; or when, after hours of restlessness, sleep is at length attained, it is disturbed by dreams and nightmare, and is sometimes associated with nocturnal emissions.[2]

The heart's action is often irregular, and easily excited to painful palpitation on slight exertion, conjoined with which

[1] Cf. Yeats, Some Observations on Duodenum, Med. Trans. Coll. Phys. 1817, p. 351, and Mayer, Krank. des Wölffinger Darms, p. 10.

[2] Parkes, On the Urine, p. 225; Roberts, loc. cit. p. 43; Golding Bird, p. 159.

[3] Golding Bird, loc. cit. pp. 244, 291. Phosphatic urine and oxaluria may, indeed, occasionally occur when the condition is one of simple atony or neurosis, but it is probable that when they are persistent, or of any severity, some conditions of organic irritation, tending still further to impair the digestive power, are almost invariably present.

[1] Ibid. p. 308. This mental state, so graphically described by Dr. Bird as occurring in connection with phosphatic urine, may be found in conditions of irritative dyspepsia, when these changes in the urine are not at the time present.

[2] Chomel.

there may be at times some irregularity of action. The pulse is accelerated during the febrile movement following digestion; it is then full and compressible; at other times it becomes weak and slow, in proportion as the patient loses strength by the continuance of the dyspepsia.

In the foregoing sketch a description has been given of the leading symptoms which correspond to cases where the anatomical characters, hereafter to be described, are found; but the whole of this group does not invariably appear simultaneously. The course of the disorder is also modified by the various etiological conditions under which it occurs, bringing certain symptoms into greater prominence than others, and also by its occasional complication with some of the neuroses, to which reference has previously been made, and which are among the chief sources of obscurity in the diagnosis of the severe forms of both affections.

The most typical examples of the disease, as affecting both the digestive organs and the nervous system, are those where irritative dyspepsia has supervened in a debilitated constitution, and has been preceded by the symptoms of atonic dyspepsia. They are yet more marked if in such a constitution there is any taint of hereditary gout, which may not have been revealed by a distinct attack, but where the emaciation, weakness, and hypochondriasis are familiar to all who have had opportunities for observing these complaints.

In the scrofulous forms in children, the attention of the parents may be directed only to the pallor, weakness, and gradually progressing emaciation of the patient, and the evil is constantly aggravated through ill-advised attempts to improve the nutrition by forcing increased nourishment on a stomach already incapable of digesting the normal amount. Phthisical dyspepsia, on the other hand, is often painfully complicated by the diarrhœa proceeding from ulcers in the intestines, but which possibly in some degree aids in preventing the oppression and hypochondriasis which so frequently attend the constipation presented by some of the other varieties.

There yet remains a group of cases where vomiting constitutes a more prominent symptom than in those which have hitherto been passed in review, and where there occurs a profuse secretion of mucus, and which stand in the same relation to the forms in which this is not so apparent as a bronchorrhœa, or leucorrhœa, or nasal catarrh occupy to the drier forms of inflammation of the mucous membrane from which those fluxes may proceed. The cases where gastrorrhœa is a prominent symptom are ordinarily those of congestion of the stomach from pulmonary, cardiac, or hepatic disease, and of dyspepsia in habitual drunkards, in which the last-named cause of congestion often, I believe, plays a prominent part; and to these must be added many cases of albuminuria.[1]

Sometimes the vomiting in albuminuria occurs on first rising in the morning, when it is occasionally relieved by food:[2] under these circumstances it is possible that it is of cerebral origin, and is caused by the disturbance of the nervous centres through the poisoning of the blood: but in a large class it takes place within half an hour to an hour after food has been taken. Pain, though sometimes present, and occasionally severe, is, however, but rarely complained of; and though much acidity is sometimes present, the reaction of the vomited matters may be at other times alkaline: but the cause of this difference has not, as far as I am aware, been made the subject of special observation.

In the dyspepsia of drunkards the vomiting of mucus is often one of the most prominent symptoms. It usually occurs in the morning, and is easily excited by slight stimuli. During the rest of the day there may be comparatively little disorder in the stomach, though acidity and flatulence are sometimes present, and the appetite is often greatly impaired. In other cases a painful sense of sinking is experienced at the epigastrium, together with a craving for the accustomed stimulant, which too often replaces all desire for food. The disturbances arising from this indulgence affecting the nervous system, the ascites and sallow skin, the icteric tint of the conjunctivæ and the signs of cirrhosis, belong more properly to other sections of clinical medicine and pathology.

In some cases, however, a symptom common to it and to other forms of congestion occurs, viz., hæmatemesis, which may occasionally be profuse, and return with such frequency as to threaten life, and to reduce the patient to an extreme degree of anæmia. The severer forms are most frequently associated with cirrhosis of the liver, causing obstruction of the portal vein; but minor degrees of the affection often appear in conjunction with disease of the kidney. It is very probable,

[1] Bernard's experiment has shown that after extirpation of the kidneys a continuous secretion takes place from the stomach without any necessary alteration of its mucous membrane; but in cases of longer duration of Bright's disease pathological observations have convinced me that the stomach seldom fails to exhibit signs of subacute inflammatory action (see also Rayer, Mal. des Reins, ii. 347). These anatomical changes are probably due to the continuance of the unnatural secretions.

[2] Christison, Granular Degeneration of the Kidneys, p. 96.

judging from the results of post-mortem observation,[1] that hemorrhage not unfrequently takes place without being disclosed by the blood vomited, the matters brought up being chiefly alkaline mucus (sometimes considerable in amount, and which may here and there only have a coffee-ground tint), bile, or altered food. Sarcinæ are occasionally found in the vomited matters of the whole of this group of cases.[2]

Pain in these cases is a symptom which is variable in the frequency of its occurrence; it is often complained of after each meal, but is seldom, if ever, of marked severity. Flatulence is almost constant. Acidity is common, but is not comparatively so frequent. The progress of the disorder, in other respects, depends much on the complications with which it is connected.

PATHOLOGY.—The changes which accompany the more marked forms of this disorder are tolerably characteristic. Many of them are apparent to the naked eye; others are only disclosed by microscopic examination. The most distinctive of these are alterations in the vascularity of the mucous membrane, changes in its color, increase in its thickness and resistance, occasional increase of the lymphatic elements in the intertubular tissue, and various forms of degeneration of the glandular and other structures.

The degree of post-mortem vascularity, however, presents the same difficulties as a criterion as were mentioned in the description of the appearances observed in the acuter form; and even congestion from obstruction, sufficient to give rise to hemorrhage, may leave no distinct traces in the mucous membrane after death. Often, however, the long continuance of distension of the vessels produces an amount of dilatation, which, when combined, as the affection frequently is, with exacerbations of an acuter kind, gives greater post-mortem evidence of hyperæmia than is found in the cases when inflammatory action has been of shorter duration.

Where much congestion has been present, the hemorrhagic erosions previously alluded to are also very common,[3] and they depend on an extravasation of blood in the substance of the mucous membrane, which results from capillary rupture. They seldom exceed two or three lines in diameter, and they are generally superficial; but they may be sometimes seen extending through the whole depth of the mucous membrane. In some places the tissue may be seen still infiltrated in patches, where the blood has been effused, without detachment of the softened surface; but in others there are seen little pits or depressions with a blackened base, and with sides still infiltrated with blood, which, on microscopic examination, is found to occupy the tubules, staining their epithelial contents. They may possibly in some cases be the source of pain, but, when small, they appear to have little other pathological significance.[1] Vascularity may be found in any part of the mucous membrane; but changes of color and thickenings of the tissues are more common in the pyloric portion, as also are many changes in the glandular tissue hereafter to be described.

The most characteristic change in color is an ash-gray pigmentation,[2] which, when closely examined, is found to depend on minute black specks scattered closely over the surface of the membrane. It is generally most marked in the pyloric half of the stomach, though traces of it may occasionally be met with near the cardia. When examined with the microscope, these spots are found to depend on pigment derived by imbibition from the hæmatin of the blood, and deposited in a minutely granular form in the cells of the connective tissue between the tubes, and sometimes in the epithelial contents of the latter. It is most commonly met with when mechanical causes of congestion have coexisted with catarrhal changes, and requires probably, as an antecedent condition for its production, the rupture of capillaries in the superficial layers of the membrane; and it is very commonly associated with similar changes in other parts of the intestinal tract.

[1] See Handfield Jones, "Stomach," p. 91, where grumous blood was found in the stomach after death, none having been vomited during life. I have met with several such cases.

[2] For the more special description of the nature of the matters ejected, the reader is referred to the chapter on Vomiting as a symptom.

[3] Willigk, Prager Viertel-Jahreschrift, vol. 51, gives their frequency as 1·8 per cent. of all the bodies examined. I know of no statistics mentioning their relative frequency to causes likely to produce these extravasations.

[1] Larger extravasations appear, however, sometimes to serve as the origin of the chronic ulcer of the stomach.

[2] Andral described a milky-white color of the membrane as characteristic of chronic inflammation. There is generally a certain degree of opacity induced in this condition; but unless an acute affection should have supervened before death, I do not think that it is common in this disease, except in spots resulting from fatty degeneration of the glands, presently to be noticed. In some of his cases the appearances described are those of the cicatrices of ulcers. (See Clin. Méd. i. 153, 154.)

But though its presence is a valuable indication of the causes in which it has had its origin, its absence by no means excludes the diagnosis of past inflammatory action, of which other and independent evidence can be found in the consistence of the membrane and changes in the glands, and which, though often associated with pigmentation, can also frequently be discovered when this is absent.

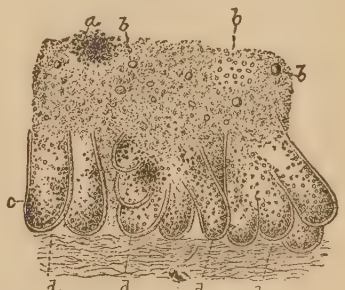
Thickening and induration of tissue are an almost uniform result of chronic inflammatory action in the mucous membrane of the stomach. This may at times acquire an extreme degree of firmness and resistance,[1] tearing with great difficulty, and being capable of being stripped from the submucous tissue in large pieces. There may be sometimes a slight degree of softening of the surface, when recent inflammation has supervened on the chronic form, but it does not usually extend sufficiently deeply to affect the general characters of induration which are so characteristic of this state. These changes depend on an increase of the interstitial tissue between the glands, which is often associated with atrophy of the latter; but it may also exist when this secondary change has not ensued.

Enlargement of the solitary glands, together with an increase of the lymphatic interstitial growths between them is common, though not constant, in this form.

The mammillation considered by Louis[2] as a constant sign of inflammatory action, and coincident usually with the other appearances now described, has given rise to considerable diversity of opinion among pathologists regarding its origin.[3] It is almost invariably found in the neighborhood of the pylorus rather than in that of the cardia, where only very slight traces of it can be discovered. The appearance described by Louis, of irregular prominences more or less rounded, of two or three lines in diameter, separated by sulci, and resembling the granulations upon wounds, when found in a healthy stomach most commonly results from the contraction of the muscular layer shown by Brücke[4] to exist around the basis of the secreting glands[5]. A very similar appearance may, however, be produced by hypertrophy and distension of the gland tubes with the products of secretion,[1] forming, together with the thickened interstitial tissue,[2] small granulations,[3] which are often rendered increasedly apparent by the atrophy of adjacent structures, and which thus present a counterpart in the stomach to the conditions observed in the granular kidney, and in cirrhosis of the liver.

Coincidently with the above, other changes take place in the secretory structures, which must necessarily tend greatly

Fig. 5.



Tubular glands in advanced stage of chronic catarrh; tubes having a thickened membrana limitans (*c*) are filled with oil-globules. (*a*) Mass of pigment in tissue. (*b*, *b*) Free oil-globules.

to impair their functional activity. They may be briefly summed up as consisting in fatty degeneration of the glandular epithelium, associated with thickening of the membrana limitans, and finally tending to changes in the shape, or atrophy of the glands.

Fatty degeneration of the glands generally occurs in the stomach, as in other glandular organs, in scattered groups, of one or two lines in diameter, giving the

[1] This was noticed by Broussais (Lec. Phleg. Gastriques, 1823, p. 105), who gave it the term "coriaceous." I have frequently found the membrane almost as tough and resisting as leather.

[2] Rech. Anat. Path. 1826, p. 111, "Etat Mamelonné."

[3] See Hodgkin, Morbid Anatomy of Mucous Membrane, ii. 280.

[4] Bericht der Wiener Akad. 1851.

[5] If sections are made of membranes in this state, after hardening in chromic acid, it will be seen that the depressions consist of a group of from ten to twenty glands dragged down, as it were, below the surface of the others, but perfectly healthy in every other respect, and with no sign of atrophy of the glands, or of alteration of the surface.

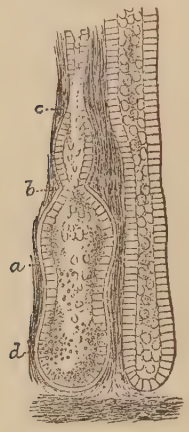
[1] Andral. Clin Méd. ii. 76.

[2] It is, I think, possible that the mere thickening of the interstitial tissues, especially when this is reduced by a rapid increase of lymphatic growth, may in some instances alone suffice to induce this appearance.

[3] Polypoid growths of various sizes may form, especially in the pyloric region, which are due to the same cause (Rokitanski, Path. Anat. 1861, iii. 154, 155). They are not necessarily associated, however, with inflammation, though they are often very marked around cancers of the stomach. See also Andral, Prec. Path. Anat. ii. 50, 53; Clin. Méd. ii. 60. A complete monograph on this subject has been published by Ebstein, Reichert and Du Bois Reymond's Archiv, 1864.

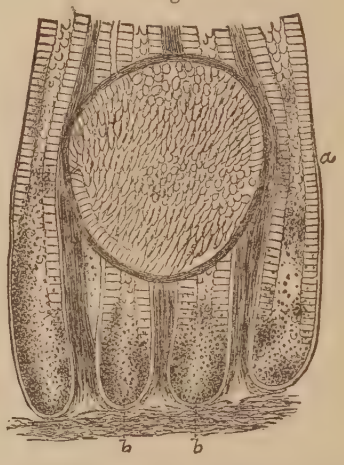
appearance of small dead white spots imbedded in the mucous membrane. When microscopically examined, the epithelium of the tubes is found either fattily degenerated or the cells have entirely disappeared, and the contents of the tubules consist of nothing but free fat granules. The tubes are often irregularly narrowed and puckered, and thickening of the membrana limitans may not unfrequently be observed around their bases;[1] and these changes lead finally to the obstruction of the tubes at some part of their length, and to the formation of cysts, from the distension of the portion below the obstruction with the products of secretion.[2]

Fig. 6.



Commencing formation of cyst by constrictions of tubular glands at (*b*) and (*c*); (*a*) thickened membrana limitans; (*d*) fatty degeneration of contents of tube.

Fig. 7.



Cyst of stomach filled with columnar epithelium: (*a*) adjacent tubes, the contents of which are undergoing fatty degeneration; (*b*, *b*) thickened membrana limitans.

Spots of fatty degeneration are also found, affecting both the gland-tubes and interstitial tissue, which sometimes extend through the whole thickness of the membrane, and are in some cases attended with a similar degeneration both of the capillaries and of the smaller arteries leading to the spot affected. These changes sometimes lead to a breaking down of the tissue, which resembles that seen in the superficial fatty degeneration of the lining membrane of the aorta, to which Prof. Virchow has applied the name of "fatty usur."[1]

Fig. 8.

Fatty degeneration of mucous membrane: (*a*) fatty degeneration of intestinal tissue; (*b*) fatty degeneration of corium.

Cases of chronic gastro-intestinal catarrh are sometimes found associated with the lardaceous, waxy, or amyloid degeneration; which, however, usually only occurs in these viscera when other tissues of the body, the liver, spleen, kidneys, and mesenteric glands, are largely affected with the same disorder. The extent to which the degeneration proceeds differs in individual instances, as also do the signs of the accompanying catarrhal action. During life, diarrhœa is often present, especially when leucocythæmia or albuminuria have coexisted;[3] in other instances I have observed this change associated with

[1] Cellular Pathology Chance's Translation, p. 340.

[1] This, which is an inflammatory change, met with also occasionally in the acuter forms, requires to be distinguished from a fallacious appearance of the same kind which sometimes follows the addition of liq. potassæ or liq. sodæ to a section of healthy mucous membrane. The pathological change may be recognized without reagents, which does not produce this effect.

[2] Further details on the structure and mode of origin of these cysts will be found in another work by the author, "Diagnosis and Treatment of Dyspepsia," and also in a paper by him, Med.-Chir. Trans. vol. xli.; also in Dr. H. Jones's work, p. 115.

[3] Bennett, Princ. and Pract. Med. 532. Löschner und Lambl. aus dem Franz Joseph Kinder Spital, Beobachtungen und Erfahrungen, 1860, p. 341 et seq.

absolute anorexia, and in one case with great irritability of the stomach, and vomiting. I have also found the disorder associated with much hyperæmia of the stomach, together with thickening and induration of the mucous membrane, and with fatty degeneration of the epithelium in parts where the specific lardaceous changes were but little apparent. These present the well-known reaction of a brownish-red color with iodine, extending to variable depths of thickness in the mucous membrane, which is also usually simultaneously found in the villi of the intestines. In the stomach, in some instances, all traces of the epithelial cells are destroyed, and the contents of the tubes are converted into the refracting, homogeneous, irregular masses, into which the histological elements of the tissue are always changed in cases of this disease.

The exact relationship borne by this degeneration to the catarrhal conditions has not as yet been fully elucidated; it is probable that the two disorders may proceed *pari passu;* and such a combination is most prejudicial to the digestive process, as is seen from the rapid and marked emaciation which is so common an attendant on the lardaceous disease.

The Diagnosis of chronic catarrh of the stomach presents many difficulties, and in some cases the recognition of its etiological relationships is necessary for its successful treatment. Among these may be especially mentioned the forms when vomiting occurs from alcoholic excesses, from albuminuria, and from congestion through cirrhosis of the liver, to which, however, no further allusion appears necessary than the descriptions already given.

The chief points of distinction from atonic dyspepsia have been already alluded to.

The distinction between chronic catarrh and disturbance of the functions of the stomach from nervous derangement may be difficult in some cases of hypochondriasis, and also occasionally when vomiting forms a prominent symptom of the former class.

With respect to hypochondriacal affections, the diagnosis is often obscure, particularly as both forms are not unfrequently simultaneously present. Pain and severe uneasiness are more constantly complained of in hypochondriasis. Pyrexia, thirst, acidity, flatulence, or other disturbances of digestion, especially when associated with impairment of nutrition, are more distinctive of catarrh. The tongue also affords, in some cases, a reliable clue to the nature of the disease. The character of vomiting in catarrh is less easily mistaken for that of nervous origin. In the former it is rare and only occasional, and mucus is an almost constant product. In neurotic conditions the vomiting is never constant. It then occurs soon after food: it is rarely associated with cachexia, or with the signs of the disordered digestion just indicated. The existence of an hysterical diathesis, or of some of the other distinguishing features of the neuroses, is usually also a sufficient guide to an accurate diagnosis.

The diagnosis from ulcer and cancer may be doubtful in those cases in which vomiting is frequent, and especially when hæmatemesis occurs. Hæmatemesis in chronic catarrh is, however, almost invariably associated with congestion, and the diagnosis of its origin must depend mainly on the absence of severe pain; aggravated by food, and on the discovery of causes of obstruction to the venous circulation in the liver, heart, or lungs. On the other hand, when chronic inflammatory action is complicated by neuralgic pain, we have other criteria in the absence of hemorrhage or of the signs of a tumor.

Tenderness on pressure also is entirely absent, or exists only in a much slighter degree in catarrh than in cases of ulcer and cancer. [Although it may possibly be a question rather of terminology, cases to which the term chronic gastritis has been commonly applied are frequent, in which decided epigastric tenderness is present.—H.]

The Treatment of chronic catarrh of the stomach requires considerable diversity, according to the varied etiological conditions under which the disease may occur.

In cases succeeding an acute attack, the sedative plan of treatment is that which is usually followed by the most favorable results. Of all single remedies bismuth is the one which ordinarily proves the most efficacious, and it may often be advantageously combined with magnesia, or, where there is much nervous irritability of the stomach, with morphia and hydrocyanic acid, in the manner before mentioned. The chief indications for its use in this state are, pain or uneasiness at the stomach after taking food, together with a sense of load at the epigastrium, followed by acidity, and combined with a red and irritable tongue, or with one furred in the centre and red at the tip and edges.

The value of opium will be further treated of in relation to some of the special forms of the disorder.

In other cases of longer standing, more direct astringents are serviceable. The most useful of this class are the nitrate or oxide of silver, the former of which should be given in the solid form in doses of a

quarter of a grain to one grain combined with opium, the latter in doses of one grain to two grains; the oxide of zinc, in doses of two grains to three grains; alum in solution, in doses of two grains to five grains; tannin or decoction of oak bark; and matico.

Arsenic in minute doses has been recommended by some writers as a valuable remedy. I have tried it in some cases, but hitherto without success: and we have not as yet obtained any definite indications for those in which it is likely to prove suitable; while it certainly aggravates the affection in cases for which it is not adapted.

The mineral acids are very useful, when given with meals, as aids to digestion, particularly when the atonic condition is also present. It is only in marked forms of irritation that their use is contra-indicated. Their utility is sometimes considerable in the dyspepsia of phthisis, as pointed out by Trousseau,[1] though in this form, when the irritability of the stomach is very marked, sedatives and alkalies often succeed better—or at least until the acuter degree of the affection has subsided. They are also often of peculiar advantage in cases of irritative dyspepsia associated with deposits of oxalate of lime in the urine, and they are occasionally of service when the urine is phosphatic; but their influence in relieving either of these conditions depends on their power of improving the digestion, rather than on any effect produced by them on the composition of the urine, on the reaction of which they have very little direct influence.

Antacids and absorbents, administered between the periods of food, are useful when flatulence or acidity is present. Where the former predominates, magnesia suspended in equal parts of infusion of rhubarb and aq. menth. pip. often gives relief. Where heartburn alone is present, a scruple to half a drachm of the bicarbonate of potassa or soda may be taken dissolved in half a tumbler of water; and this treatment is sometimes beneficial when there has been a feeling of load and uneasiness three or four hours after a meal, accompanied with great physical languor and intellectual depression: the same advantage may also be obtained by drinking a tumbler of Vichy water between the meals, and also on retiring to rest at night.[2] They are further useful when urates or uric acid appear in the urine, and particularly in the acid dyspepsia of gouty cases. Caution, however, is required in order that the habit of taking these substances does not become confirmed, as more permanent injury to the digestion may result from their prolonged use.

Pepsine is also often of value in this disorder. I have found it especially so in the dyspepsia of scrofulous children, when the tongue is red and irritable; but I have employed it also under other circumstances with great utility.

Purgatives are only to be employed with caution, and cases of chronic irritative dyspepsia are often aggravated by a persistence in their use. In children especially, their frequent employment, and particularly that of mercurial "alteratives," is very undesirable.[1] Nor are these remedies indicated by the occurrence of pale, yeasty stools, which proceed as often from imperfect gastric digestion as from disordered "liver."

In some cases of long-standing, irritative dyspepsia, arising chiefly from excess in eating, benefit often accrues from free purgation with mercurials, and in gouty patients of this class colchicum may sometimes be advantageously added. Podophyllin is also of use in these circumstances.

Mercurial purgatives are also of use in cases of congestion of the stomach arising from disorder of the liver, even when this is so severe as to give rise to hæmatemesis or melæna.[2] They have also favorable effects in some cases of this class, when pain is present, associated with the vomiting of ropy mucus,[3] though in these the subsequent administration of astringents is necessary to complete a cure.

Cases occasionally occur when a severe and long-continued inflammatory condition of the stomach, which has resisted all other remedies and also a careful dietetic regimen, yields promptly to a mild mercurial course sufficient to touch the gums; after which, medicines that had previously been unavailing have proved beneficial.[4]

[1] Traité de Thérap. i. 206. Clin. Méd. ii. 1862, p. 337.

[2] Whytt (Works, p. 664) recommended, for persons troubled with mucous vomiting, a tumblerful of lime-water, to be drunk on an empty stomach in the morning.

[1] "And with reference to mercury, I would advise you to have your gray-powder bottles marked *Dangerous, especially in alterative doses.*" (Sir W. Jenner, Lectures on Rickets, Med. Times and Gazette, 1860, p. 446.)

[2] These are the cases in which purgatives prove efficacious in the relief of this symptom (Sir T. Watson, loc. cit. ii. 435); but great care is necessary in the diagnosis, as they aggravate those in which the hemorrhage proceeds from ulcer or cancer. In some instances, however, the hemorrhage from congestion may be sufficiently severe to threaten life, under which circumstances the ordinary means for checking the flow must be resorted to.

[3] Barlow, art. "Gastrodynia," Cyc. Pract. Med. iii.

[4] This plan, laid down by Dr. Hunt (Heart-

The same method has been followed by the author with success in cases where there was a suspicion of a syphilitic origin of the disorder of the stomach.[1] [In such cases the use of the blandest, least irritating articles of diet, as rice, arrowroot, lime-water and milk, &c., is very important.—H.]

Habitual constipation may be relieved by two or three grains of the pil. aloes dil. taken with food, which may sometimes be advantageously combined with the extract of nux vomica; or by two or three drachms of the decoct. aloes aquos. taken before rising in the morning. When piles exist, the action of the bowels may be procured by the use of the Püllna or Friedrichshaller waters, or by a few drachms of the potassio-tartrate of soda, taken before breakfast. Castor-oil also proves an excellent laxative in such cases; but the use of all these remedies should be avoided as far as possible, and the action of the bowels should be solicited by the daily use of enemata of cold water.

The employment of belladonna in doses of one-tenth to half a grain, as recommended by Trousseau,[2] also proves occasionally beneficial.

Many of the natural mineral waters have a very decided beneficial effect in restoring a healthy condition of the functions of the alimentary canal when suffering under chronic catarrhal affections. The most valuable in this respect in our own country are those of Harrowgate, Bath, and Leamington. The waters of Carlsbad and Marienbad are also valuable in these complaints — the former being most useful when there is much portal congestion, and the latter when the disorder depends more on simple irritation of the gastro-intestinal canal, and also in young persons who suffer from constipation.[3] The mineral waters of Kissingen, containing a large proportion of iron, are also of service when general atony or anæmia is combined with the irritative state of the mucous membrane. Those of Vichy are of great general utility as alkaline remedies, and are also specially applicable to dyspepsias of gouty origin; and though the efficacy is less explicable, the springs of Pouges, Plombières, and Bagnerres de Bigorre have obtained a high reputation.[4]

The condition arising from the abuse of alcoholic stimulants requires certain modifications of the plans above indicated. Occasional mercurial purgatives prove most undoubtedly beneficial; but when there is much irritability of the stomach or vomiting of mucus, opium has a special value. Its action may often be assisted by its combination with astringents, and particularly with the compound kino powder. Its beneficial effect appears to be of a twofold character: locally, it allays the irritation of the stomach, and checks the excessive mucous secretion; while, by tranquillizing the nervous system and procuring sleep, it restores the tone of the digestive organs, and frequently enables the patient to digest solid food. Opium is also of use in cases of subacute inflammatory action, combined with great nervous irritability, and where atony also exists; it may often be given with advantage combined with nitrate of silver, as before recommended.

The simple bitters may be used in these cases when the acuter symptoms have subsided. Strychnia, or nux vomica combined with the mineral acids, or the oxide of zinc, are also remedies which are specially applicable to the state of combined disturbance of the nervous system and of the digestive functions which these cases exhibit.

The disturbance of the digestive organs associated with albuminuria is often greatly relieved by free purgation with the compound jalap powder, as pointed out by Dr. Budd.[2] The vomiting is, according to the author's experience of the disease, more effectually checked by ice than by any other remedy. In these cases an animal diet often suits better than a vegetable, and large quantities of slightly underdone meat may sometimes be taken with considerable advantage. Creosote, as recommended by Rayer,[3] as a means of checking vomiting from this source, is sometimes also useful; but its efficacy is somewhat uncertain.

The irritative dyspepsia of phthisis offers greater difficulties to a complete cure than almost any other of the forms of this disorder. One essential point to be borne in mind with regard to it is the necessity of chiefly employing sedative remedies; and of these I have found none so efficacious as hydrocyanic acid, the value of which remedy is, I believe, more marked in this disorder than in almost any other form of dyspepsia. It may be most usefully combined with the carbonates of potassa or soda, and given, in combination with infusion of calumba, twice or three times daily, in the intervals of meals.

Bismuth may also be employed with

burn and Indigestion, p. 73 et seq.), has been illustrated by some cases of Dr. H. Jones.

[1] See also Trousseau, Traité de Thérap. i. 269; Andral, Clin. Méd. ii. p. 201 et seq.

[2] Clin. Méd. ii. p. 381.

[3] Oppolzer, Zeits. Gesellsch. Aertste zu Wien. Canstatt, 1857, iii. 175.

[4] Trousseau, Clin. Méd. ii. 379.

[1] Andral, Prec. Anat. Path. ii. 204; Budd, Dis. Stomach.

[2] Loc. cit. p. 248

[3] Mal. des Reins, ii. 347.

advantage, especially when there is diarrhœa, under which circumstances its combination with opium or morphia is indicated.

The dyspepsia of scrofulous children—in whom the tongue is red and irritable, the complexion sallow, the spirits uneven, the general strength deficient, as shown by frequent complaints of lassitude, the appetite irregular and often voracious, but not unfrequently perverted, and the bowels irregular (the motions being sometimes loose and pultaceous, and at others scanty and confined, but generally pale and offensive); and who often complain much of thirst—or of those of relaxed and atonic constitutions, in whom the external signs of scrofula are not well marked, is another form which requires great care both in treatment and diet. This caution applies especially to the use of purgatives, and particularly to mercurials, which seldom fail to aggravate the condition.

The first and most essential point to be attended to in such cases is the regulation of the diet, both as to quality and quantity: *all* indigestible substances are to be carefully eschewed, and the amount of animal food is to be strictly limited until marked improvement in the digestion has taken place.[1] Great care is necessary also in insuring the due mastication of food; and when children have acquired the habit of performing this imperfectly, they often require to be carefully watched during some weeks, until it has been overcome. Animal food may in such cases often be advantageously minced; but it must be remembered that the necessity of mastication is equally to be insisted on with all the food taken.

Mercurial purgatives are contra-indicated, and constipation is to be met by small doses of rhubarb and soda, or by castor or olive oil. A few stewed prunes may often be advantageously allowed with the meals; but other fruits, with the exception of strawberries, are, as a rule, to be avoided. The use of vegetables is only to be very cautiously permitted; and in severe cases they are to be forbidden.

[1] In carrying out this system the physician will often have to encounter no little difficulty from the friends of his patient, who, seeing the loss of flesh and strength, not unfrequently endeavor to remedy the weakness by increased food, wine, and tonics—a plan which unfailingly tends to aggravate the symptoms, whilst an opposite procedure, during a limited period, is often productive of the best results. I have known the most obstinate irritative dyspepsias of this nature cured under a system of diet from which, during nine weeks, animal food has been almost entirely excluded, and the patient restricted to the use of light farinaceous puddings and bread and milk.

As long as marked irritation persists, it is desirable to continue the use of sedatives, and of these bismuth is the most efficacious; but small doses of the carbonated alkalies, with one or two drops of dilute hydrocyanic acid combined with infusion of calumba, may be given.

The condition of atony which underlies these cases is best treated by pepsine and iron; the latter should be given in the neutral form or combined with alkalies; and when the stomach permits of its use, the administration of cod-liver oil is often markedly beneficial. General hygienic measures are also carefully to be observed, and particularly the use of warm clothing;[1] sufficient exercise in the open air, and good ventilation of the day and sleeping apartments. Cold or sea bathing must be regulated by the vigor of the reaction of the skin. Sponging with salt and water is sometimes advisable.

The warm bath, on the other hand, is frequently beneficial when the stomach is irritable, and particularly so in children of gouty or rheumatic parents.

A very important point to be recollected in these cases is that they are liable to frequent relapses, and that under such circumstances a return for a few days to a restricted diet and a sedative treatment becomes absolutely necessary.

The weakened state of the digestion, which often remains long after signs of irritation have appeared, requires the cautions respecting the treatment of such cases given in the chapter on Atonic Dyspepsia. The amount of food taken should be regulated by the digestive power of the stomach.[2] Stimulants should only be taken in great moderation, and of these the drier varieties of sherry, or claret, or Chablis, should be preferred.[3]

The advantages of moderate exercise, and of change of air and scene, cannot

[1] The exposure of young children of delicate constitutions to cold, by imperfect clothing, in the manner so commonly practised, cannot be too strongly reprobated.

[2] It is very difficult to prevent patients in this condition from eating more than their stomachs can digest, under the erroneous idea of thereby regaining health and strength: it is not uncommon to find feeble subjects of irritative dyspepsia using very little exercise, and taking meat three times daily, together with a considerable quantity of stimulant, and with beef-tea once or twice in the intervals, who improve at once and rapidly on submitting to a restricted diet. The just medium in these cases is at all times one difficult to attain, but the effects of a certain degree of abstinence are often most beneficial, and it is rarely that it is carried too far, at least in comparison with excesses in the opposite direction.

[3] Their entire omission will have the best effect, in the large majority of cases.—H.]

be too strongly insisted on, and are often productive of the happiest results. One very important point to be attended to is that patients should always wear flannel, and be sufficiently clothed to protect them against the effects of change of temperature, to which they are peculiarly liable; and the general regimen of atonic dyspepsia should be most carefully observed.

VI.—Chronic Ulcer of the Stomach and Duodenum.

Synonyms.—Perforating Ulcer (Rokitanski); Simple Ulcer (Cruveilhier); Round Ulcer; Corrosive Ulcer (Müller); Ulcer of Stomach (Brinton).

Definition.—A disease characterized during life by pain in the stomach, and usually associated with vomiting, hemorrhage, and disturbances of the digestion, and terminating either in cure, or in death by hemorrhage, perforation, or marasmus. Its essential anatomical character consists in a circumscribed loss of substance of the coats of the stomach or intestine, extending for a variable depth through their tissues, which is sometimes associated with inflammatory thickening of its margins, but is not attended by any other morbid growth.

History.—It is probable that a large number of the cases described by the earlier writers under the titles of Cardialgia, Gastrodynia, Hæmatemesis, and Melæna were really referable to this disorder. Ulcerations of the stomach were indeed recognized by Celsus,[1] and mentioned in several places by Morgagni,[2] but their effects were confounded by other writers with rupture, either spontaneous or from violence; or they were described among the appearances produced by chronic gastritis or duodenitis (Andral, Broussais, Abercrombie). The first authors who distinctly traced the connection of the special symptoms characterizing this disease with a definite anatomical alteration were Cruveilhier and Rokitanski, who gave complete descriptions of its leading features, which have since sufficed for the basis both of diagnosis and treatment. Subsequent additions have been made to our knowledge of its pathology and etiology by Prof. Virchow and by Dr. Brinton, the latter of whom has given statistics based on a wider comparison of the published cases than had previously been attempted; and the same course has been followed by other writers mentioned below.[1]

Etiology.—*Frequency of occurrence.*—The largest data on which an estimate can be formed of the proportionate number of cases in which this disease occurs are to be drawn from the returns of Jaksch, Dittrich, and Willigk, from the hospital at Prague, who in a total of 10,203 bodies

[1] De Med. liv. cap. 5.

[2] Epist. lxv. 3, xxix. 14, 20, lxix. 3 (Ulcerations of Stomach and Duodenum from Arsenic).

[1] The principal literature of this subject is to be found in the following works: Baillie, Morbid Anatomy. Hope, Morbid Anatomy. Cruveilhier, Revue Médicale, 1838; Archives Générales de Med. 1856; and Path. Anat. du Corps Humain, Liv. xxx., xx., xxvii. Rokitanski, Med. Jahrbücher des Oesterreichen Staates, 1839, and Path. Anat. Albers Beobachtungen. Reports by Jaksch, Willigk, Dittrich, and Duchek, of clinical and post-mortem observations in the Prager Viertel-Jahreschrift, vols. iii., vii., viii., ix., xii., xiii., xiv., xxxviii., xliv., l., li. Langston Parker, Stomach and its Morbid States, 1838. Williamson, Dublin Journal, 1841. Crisp, on Perforation of Stomach, Lancet, Aug. 5, 1843. Osborne, Dublin Journal, 1845. Virchow, Archiv Path. Anat. v. 275 et seq. Chambers, Lond. Journ. Med. 1852. Handfield Jones, Med.-Chir. Trans. 1854 and Path. and Clin. Obs. respecting Morbid Conditions of the Stomach, 1855. Budd, Lectures on Diseases of the Stomach, 1855. Brinton, British and Foreign Med.-Chir. Rev. xvii. 1856; Ulcer of Stomach, 1857. Habershon, Obs. on Alimentary Canal, 1857. Luton, Rec. des Travaux de la Soc. Méd. d'Obs. 1858, vol. i. Müller, Das corrosive Geschwür in Magand und Darmkanal. The two last-named authors give a full historical account of the literature of this disease. A synopsis of the literature and valuable critical observations on the etiology of the disorder are also to be found in an article by Miquel in the Hannoversche Zeitsch. für praktische Heilkunde, 1864. For description of duodenal ulcers see Budd, loc. cit.; Mayer, Krankheiten des Zwölffinger, Darmst. 1844; and for wider statistical observations see Trier, Ulcus Corrosivum Duodeni, reprinted from the "Ugeskrift für Læger," Copenhagen, of which an abstract is given in the British and Foreign Med.-Chir. Rev. Jan. 1864, and in the Prager Viertel-Jahresch. vol. lxxxv. Also Krauss, "Das perforiende Geschwür in Duodenum," 1865. For the origin of this latter disorder, in connection with burns of the skin, see Curling, Med.-Chir. Trans. xxv.; Erichsen, Lond. Med. Gaz. 1843. See also Abercrombie, Diseases of Abdominal Viscera. Bennett's Clinical Medicine. Henoch, Klinik der Unterleibs-Krankheiten, and Bamberger, Krank. des chylopoietischen System, Virchow's Handbuch der Spec. Path. Thérap. vol. vi. For some of the references to the less accessible cases, especially in the German medical journals, the author is especially indebted to the works of Müller, Miquel, and Krauss.

examined, found 126 open ulcers and 224 cicatrices in the stomach and duodenum,[1] representing a frequency of 3·4 per cent., a result which corresponds tolerably closely with those of Dr. King Chambers and Dr. Brinton.

The returns of Dahlerup,[2] from the hospital of Copenhagen, present a marked contrast to those just quoted: in 200 bodies he found 20 open ulcers and 6 cicatrices, giving a percentage of 13 to the total number of deaths. It is doubtful whether the marked discrepancy between this observation and that of other authorities is explicable by the small number of bodies on which it is based, or by special circumstances affecting the population.

Age.—Dr. Brinton's return of 226 cases of ulcers and cicatrices, collectively, in which the age is mentioned, shows a gradually increasing frequency of occurrence with advancing years:—

Between ages of	0 to 10	to 20	to 30	to 40	to 50	to 60	to 70	to 80	to 90
No. of Ulcers	2	18	45	39	38	32	32	15	5
		65		77		84			

and allowing for the number of all persons living at these ages, the apparent preponderance of the disease in the later periods of life is very considerable.[3]

The disease is rarely met with in the earlier periods of life; but a doubtful case is recorded in a newly-born infant,[4] another instance is mentioned by Barrière,[5] in which an ulcer was formed in the duodenum in a child of six years old, Dr. Budd[1] has met with it in a girl ætat. 14½, and Dr. Brinton[2] and Dr. Buzzard[3] have found it at the ages of 8 and 9.

Other returns, though based on smaller numbers, show that there is a preponderating liability to the disease between the ages of 15 and 30.

Thus a comparison of the tables of 108 fatal and open ulcers given by Willigk and Miquel affords the following results:—

Age	10 to 20	20 to 30	30 to 40	40 to 50	50 to 60	60 to 70	70 to 80	Total.
Ulcers—Males	2	9	6	8	5	2	1	33
" Females	13	21	9	15	6	8	3	75
Total	15	30	15	23	11	10	4	108

And of 21 not fatal, by Duchek, the ages in which they occurred were:—

Age	10–20	20–30	30–40	40–50	50–60
Ulcers	3	6	7	4	1

Dr. Crisp, of 51 cases of perforation, of which 39 occurred in females and 12 in males, gives as the ages of the former:—

Age	15–20	20–25	25–30	30–60
Ulcers	21	10	5	3

Sex.—The disease appears, from the returns of numerous observers, to be between twice and three times as frequent in the female as in the male sex.

The sex of the patient appears also to exercise an influence not only on the age at which the ulcer appears, but also on that at which one of its most fatal accidents, viz., perforation, occurs, and probably in some degree on the special liability to this event. Thus by comparison of the tables of open and fatal ulcers given by Willigk[4] and Miquel it will be seen that, in the male sex, only one-third occurred before the age of 30 (11 to 22), while of the females the proportion of cases occur-

[1] Dittrich's cases, I believe, include duodenal ulcers. He distinctly mentions one such, but in most of his returns the site of the ulcers is not mentioned.

[2] De Ulcere Ventriculi Perforante; Havniæ, 1841. Canstatt's and Eisenmann's Journal, 1842. The original of this work appears to have been inaccessible to most of the writers who have quoted it, as it has also been to myself.

[3] There are, however, two fallacies in such an estimate: for in the first place the appearance of the cicatrix gives no information at what age the ulcer from which it may have resulted has occurred; secondly, the duration of life, in many cases even of open ulcer, is often very considerable, and therefore the discovery of either lesion at an advanced age affords no certain criterion of the date of its origin. That the ulcers may, however, frequently commence at an advanced age, is seen by a case of Cruveilhier's, Path. Anat., Liv. xx., and also by several recorded by Dr. Brinton (Ulcer of Stomach, Appendix).

[4] Busch, Hufeland's Journal, 1836.

[5] Malad. de l'Enfance, ii. 1, quoted by Henoch, ii. 130.

[1] Loc. cit. 115.

[2] Loc. cit. 33.

[3] Path. Soc. Trans. xii. 84. All the three last-named cases had perforated.

[4] In Willigk's cases the whole number of females examined exceeded that of the males, being 3440 of the former to 2766 of the latter.

ring within this period to those observed at all other ages was as 34 to 41. The greater liability to perforation at early ages in the female sex is apparent from Crisp's tables, and also from a large number collected by Dr. Brinton. These show that nearly three-fourths of the instances of this event in the female sex occurred before the age of 35, while in the male sex the cases of perforation are nearly equally divided among all ages, though somewhat diminishing in frequency after that of 50 had been attained.

The absolute liability to perforation in the two sexes is a matter of some uncertainty. Dr. Brinton estimated it as about corresponding to the absolute proportionate frequency of ulcerations observed,[1] but other authorities believe that there is a greater relative frequency among females.[2]

Of the influence of race and climate but little is known. But few positive facts are known regarding any influence exerted by occupation, though Dr. Copland asserts that, when occurring in the female sex, it is most common in those engaged in needlework or in domestic service.[3] There is a general impression that the disease is most common among the poorer classes, but no certain data exist for this opinion.

Among other occasional causes which have been mentioned, are moral emotions,[4] bad or insufficient food, excessive indulgence in spirituous drinks,[5] and exposure to extreme cold.[6] *Corrosive poisons*, and particularly the mineral acids, may also give rise to perforating ulcer:[1] their *modus operandi* will be easily understood when the pathology of the disease is considered.

There are certain *diseases* to which a direct causative influence has been ascribed in the production of the complaint, and which deserve a passing notice.

Amenorrhœa is perhaps the one which holds the most important rank among these, but precise information is wanting regarding the exact relation of the two disorders. It appears to be pretty certainly established that, though menstruation is sometimes regularly maintained after ulceration, especially in middle-aged females (Brinton), yet that disturbances in this function accompany ulcers of the stomach with a greater proportionate frequency than is met with in almost any other class of disorders, except perhaps tuberculosis. We possess, however, no certain information as to the number of instances in which suppression or arrest of the menstrual flow has preceded the disease of the stomach. Cases are indeed recorded in which suppression of the menses, through cold, in previously healthy females has been immediately followed by symptoms of ulceration; and in some, even after the re-establishment of the menstrual function, the symptoms of the disease of stomach recurred with each return of the uterine discharge.[2] The age at which the disease is found with such frequency in the female sex appears to point in a very distinct manner to the influence of puberty on its occurrence, and Miquel[3] states that he has observed a similar though less marked liability at the climacteric period between the ages of 40 and 50. These facts, together with the evidence afforded by Crisp[4] of the association of amenorrhœa with the liability to perforation, would tend to show that the connection between the two conditions is something more than accidental, and that, as will be further considered when

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[1] Dr. Brinton's estimate of the relative frequency of the ulcer in the two sexes gives a smaller preponderance to the female sex than do the numbers collected by other observers.

[2] In 221 cases of ulcer by Willigk there were six perforations, all in the female sex; of sixty-seven cases of perforation by Miquel, fifty-one were females; while Dr. Crisp's tables, before quoted, give a proportion of thirty-nine females to twelve males.

[3] Med. Dict. iii. pt. 2, p. 919.

[4] See a case by Cruveilhier, Path. Anat., Liv. xx. Osborne also says that he has known the symptoms of ulceration to date from this cause; Dub. Med. Journ. xxxvii. p. 357.

[5] Leudet, Congrès Méd. de France, 1868, 104. In twenty-six cases of drunkards, Leudet found eight cases of ulcer, open or cicatrized. He calculates that one-third of the whole number of ulcers found by him were associated with habits of intoxication. See also Klob, Bericht über die Wiener Sammlung (Canstatt's Jahresb. 1850, quoted by Leudet); also Huss, Alcoholismus Chronicus, p. 5. Leudet further gives cases where hæmatemesis followed the drinking of large quantities of alcohol.

[6] A case by Förster, Wurzb. Med. Zeitsch. 1864, ii. 164. The etiology of this case is doubtful. The patient had been exposed to great cold, and drank a large quantity of raw spirits. There was perforation of the posterior wall of the duodenum with an abscess in the retro-peritoneal tissue. Förster thought it possible that the spirits might have produced an excessive secretion of gastric juice leading to the perforation.

[1] See a case of perforating ulcer of the stomach caused by swallowing hydrochloric acid, related by the author, Path. Soc. Trans. xix. 239.

[2] See Miquel, loc. cit. 145.

[3] Loc. cit.

[4] Dr. Crisp found that, in thirty-nine cases of perforation, the state of the menstruation was not mentioned in twenty-five. In the remaining fourteen, it was present and regular, in one; irregular, or suppressed, or had never appeared, in thirteen.

the pathology of the disorder is discussed, these disturbances, when preceding the appearance of the ulcer, may be reasonably supposed to have a direct influence on its origin.

The influence exerted by the states of anæmia or chlorosis on the occurrence of ulceration is less evident. They have been very frequently observed in cases of perforation,[1] which, under these circumstances, may in part be due to the absence of sufficient vitality to allow of the projective thickening of the edges and base of the ulcer, by which this accident is commonly prevented. It is stated, however, by Miquel, that a sound condition of health has often in the female sex immediately preceded the ulceration.

Tuberculosis is met with in a great number of cases, but, as shown by Dr. Brinton, "the percentage of tubercle in cases of gastric ulcer does not seem to exceed its average in all persons indifferently;" nor do other diseases of the lung appear to exert any direct influence on its production.

The coincidence of the ulcer with the puerperal state mentioned by Chaussier has been brought into prominence by Jaksch's returns, who found that, of 91 females, it occurred in 10 during the period of child-bed. Rokitanski was of opinion that the occurrence of intermittents predisposed to the disorder, and Engel[2] says that in 10 per cent. of his cases the patients were syphilitic. Krauss says that the disease has commenced after suppression of hemorrhoidal discharges; Miquel, after the healing of old ulcers on other parts of the body.[3] The association of the disorder with diseases of the liver will be alluded to in the history of its pathology.

Of the other diseases with which it is most commonly found associated may be mentioned those of the heart, though by no means exhibiting a great frequency of occurrence in proportion to the whole number of cases dying of these disorders.

Another affection which appears to act as a direct cause of these ulcers, but the effects of which are remarkable as being almost wholly confined to the duodenum, are burns of the skin. Their influence in this respect was pointed out by Cumin,[1] Dupuytren,[2] Cooper,[3] and Long,[4] and was more fully brought forward by a collection of cases published by Mr. Curling,[5] and in a memoir by Mr. Erichsen.[6] Mr. Holmes[7] has recently given further illustrations of their comparative frequency; in 125 cases of severe burns collected by him, the duodenum was ulcerated in 16, and other portions of the intestines in 2 others. The earliest period at which the ulceration has been discovered has been on the 4th, 5th, or 6th day. The age of the patient exercises no influence on the result, nor does apparently the situation of the external injury.

Morbid Anatomy.[8]—It has been already stated, in the definition above given, that the essential anatomical alteration of this disease is an ulcer or ulcers of the coats of the stomach.

The term as thus used is not, however, applied to all forms of ulceration of the mucous membrane, and it does not embrace either the superficial or the follicular erosions, which have been previously described as found in catarrhal inflammations of the organ. Nor, in the author's opinion, should the superficial hemorrhagic erosions be included in the definition of this disease, though its relation to the latter form will be again alluded to.

As distinguished from the above forms, the chronic or perforating ulcer of the stomach is one which extends for a greater depth in the tissues, sometimes passing only through the mucous membrane, at others penetrating the muscular tissue, and even the peritoneum.

(*a*) *Character and Appearance of Ulcer.*—It is found in two conditions, which, as they are supposed to represent either different stages or variations in its mode of progress, it seems not unimportant to distinguish from one another.

The first of these, which is believed to be that in which the ulcer is found soon after its origin, presents a sharply defined loss of substance of variable depth in the coats of the stomach; it may then, when affecting only the mucous membrane, have a flattened appearance, with clean-

[1] Especially by Crisp.

[2] Prager Viertel-Jahresch. vol. xl. p. 7. As, however, he does not give the whole numbers on which this calculation was founded, its relative value can scarcely be estimated. The evidence of disturbance of the stomach from a syphilitic taint does not show conclusively that the cause is due to ulceration. See Andral, Clin. Méd. ii. 201 et seq., and Höring, Schmidt's Jahrbücher, 88.

[3] Two cases, loc. cit. 143. See also a case quoted by Cruveilhier, Liv. xx., where the disease in the stomach commenced in a patient æt. 62, after the healing of an ulcer in the skin.

[1] Edin. Med. Surg. Journ. 1823.

[2] Leç. Orales, p. 521.

[3] Lond. Med. Gaz. xxvii.

[4] Lond. Med. Gaz. Feb. 1840.

[5] Med.-Chir. Trans. 1842, vol. xxv.

[6] Lond. Med. Gaz. 1843, 789, 790.

[7] Syst. of Surgery, vol. i. p. 733 et seq.

[8] The clinical history of this disorder is in many points so fully elucidated by the pathological conditions observed in the stomach, that a departure from the usual order followed in this work appears in this instance desirable.

cut edges, looking as if they had been punched out of the tissue; when, however, the destruction has extended more deeply, it generally presents, even at this period, an appearance somewhat resembling that of a funnel whose apex is directed towards the peritoneum.[1] The edges and floor in this stage are smooth and even, the former seldom presenting any swelling or elevation above the surrounding tissue; the base, however, often shows a softened, puffy look, and minute sloughs may sometimes be found upon it. In some cases, however, the ulcer has been found with a mass of blackened blood adhering to its base,[2] or with an infiltrated extravasation of blood into its margins, or surrounded by a zone of injection in which petechial extravasations have occurred—appearances which, as will be seen, are of considerable interest in relation to the pathology of this disease, and to the experiments conducted with a view to its artificial production in animals.

In this stage the ulcer frequently perforates; but the morbid anatomy of this result of the disorder will be separately described.

When the ulcer has existed for a longer period, its walls and floor undergo an inflammatory thickening, through which its funnel-like shape becomes more distinct, and it acquires a stratified and crater-like appearance, which is less distinct, in its earlier stages. This appearance is due to the different coats being involved in areas which progressively diminish from within outwards, the mucous and submucous tissues being destroyed over a wider surface than the muscular, which thus forms the first step, and through the opening in which the thickened peritoneal and sub-peritoneal tissues are seen penetrated in a smaller extent by the progress of this disease.

The whole tissue of the wall is thickened around the ulcer, and the different coats become blended together, sometimes for a considerable distance around its margin. The new tissues by which this is effected consists of an amorphous or finely granular intercellular substance, in which are imbedded nuclei more or less thickly scattered. At a later period it is developed into an imperfectly fibrillated tissue. Occasionally, but not commonly, granulations may be seen on the sides and base of the ulcer.

The tubular glands in the immediate neighborhood are sometimes destroyed by this growth, or villous or polypoid vegetations may be developed on the mucous surface surrounding the ulcer; but in the majority of cases these appearances are not observed, and the ulcer exists only as a conical-shaped perforation of the coats of the stomach, surrounded by a thickened and indurated cicatricial margin, and resting on a base having the same characters. In rarer instances the ulcer has been found associated with suppuration in the coats of the stomach, leading to secondary thrombosis and suppuration in the portal vein.[1]

In some cases the retraction of the deeper layers may give the mucous membrane an excavated appearance, and this may proceed to the extent of causing the edges of the mucous membrane to meet in the centre (Krauss); but, ordinarily, when cicatrization ensues, it proceeds by granulations from the base, and the previous site of the ulcer is marked by a cicatrix of variable size, uncovered by mucous membrane, and surrounded by stellate, radiating lines extending into the surrounding tissue.

(*b*) *The size* of these ulcers varies from that of a fourpenny-piece to a diameter of five or six inches.[2] The larger diameters mentioned have been almost entirely met with in cases where there was reason to believe that the disease had been of long standing; and those of more recent formation, or which have run an acute course, have seldom exceeded that of a shilling or half-a-crown. Perforating ulcers have been artificially produced[3] not larger than a pin's head in diameter.

(*c*) *The shape* of the ulcer is usually round or ovoid. Coalescence of one or more may give, however, various irregularities of outline; and instances are recorded in which they have been found surrounding the whole circumference of the pylorus.

(*d*) *The number* met with in any single subject varies.

Dr. Brinton says that, out of 536 cases, two or more were present in 113, or in 21 per cent.[4] Instances, however, are mentioned in which three, four, five, or even more open ulcers have been found in the same

[1] This funnel-shaped opening, as has been observed by Virchow, does not always extend vertically into the tissue in its whole circumference, but one side may be vertical and the other sloping.

[2] Frerichs, Dis. of Liver, Syd. Soc. Trans. by Murchison, Case I. vol. i. p. 136. Bennett, Clinical Medicine, 789. Habershon, Obs. Aliment. Canal, 1862, p. 98. Also a case quoted by Mr. Curling from Long, Med. Chir. Trans. xxv. 269. Also Handfield Jones, loc. cit. 128.

[1] Dr. Bristowe, Path. Soc. Trans. ix. 275.

[2] A case is given by Law, Dub. Hosp. Gaz. ii. 51, of an ulcer measuring 6 in. by 3 in., quoted by Lees (Diseases of Stomach).

[3] Müller, loc. cit. 273.

[4] He does not, however, state whether these include cases where recent ulcers and cicatrices of older ones were present together, —a very common condition.

stomach; and Krauss says that, in the cases of duodenal ulcers observed, a plurality has been found in one-third. The simultaneous occurrence of ulcers in the duodenum and in the stomach is also, comparatively speaking, a frequent event.

(*e*) *The seat* of the ulcer is much more commonly in the stomach than in any other portion of the intestinal canal. It is very seldom met with in the œsophagus,[1] and is much less frequent in the duodenum[2] than in the stomach; but instances are recorded in which similar ulcers have been discovered in lower portions of the intestines.[3]

The seat of the ulcers in the stomach exercises an important influence on the progress of the disorder, and therefore deserves especial mention. The largest statistics on this subject are given by Dr. Brinton, who, in 220 cases in which the site was recorded, found that eighty-six were on the posterior surface; fifty-six on the smaller curvature; thirty-two on the pylorus; thirteen on the anterior and posterior surfaces, which frequently existed together, and were often opposite to one another; ten on the anterior surface only; five on the greater curvature; and four in the cardiac pouch. Rokitanski's remark, that the ulcers are more commonly seated in the immediate neighborhood of the curvatures rather than directly upon them, has been fully confirmed by more extended observation.

The majority of ulcers in the duodenum are situated in the upper horizontal portion.[4]

(*f*) *The progress* of the ulcer, when once formed, tends either to cicatrization or to extension through the coats of the organ; in the latter case leading either to perforation of the stomach or to the invasion of neighboring organs through adhesions previously contracted.

(*g*) That *cicatrization* is by far the most common result is shown by the returns before quoted, where it is seen that cicatrices are found nearly twice as frequently as open ulcers.[1]

The process by which cicatrization is accomplished has been already described, but its final results differ considerably, according to the depth and superficial extent of the ulcer, the adhesions which it has contracted to neighboring organs, and the amount of thickening which has taken place around its base and margin.

In many cases the process is not complete, and there is a proclivity to a return of the ulcerative action in the cicatricial tissue.

When the loss of substance has not penetrated deeply, or when cure has followed rapidly on the destruction,[2] the site of the injury is only marked by a white spot in the mucous membrane, attended with little or no puckering or contraction; but in other cases a similar appearance, with radiating, stellate lines proceeding from it, may be seen externally on the peritoneal covering.

In cases, however, where the ulcer has extended deeply, and where there has been great thickening of its base and margin, the contraction of the fibrous tissue, by which the loss of substance is replaced, may lead to alterations in the form and shape of the stomach. Amongst the most remarkable of these are cases when, from ulcers seated in the smaller curvature, the pyloric and cardiac orifices have been drawn into close proximity to one another;[3] or where the constriction extending around the centre of the stomach has given it an hour-glass shape, involving a special tendency to dilatation

[1] A case of this kind is given by Mr. Flower, Med.-Chir. Trans. xxxvi.

[2] Willigk found, for 225 cases in which the stomach was affected, only 6 cases of ulcer in the duodenum; and Trier, on the other hand, gives, as the relative proportional frequency in these parts, 28 cases of duodenal ulcer, as contrasted with 261 where it was found in the stomach. It is not, however, unlikely that cicatrices in the duodenum may be frequently overlooked: so that no absolute reliance can be placed on these numbers.

[3] Albers, Die Darmgeschwüre, p. 474 et seq. Lebert and Clauss, Ueber spontan. Darm-Perforationem, Diss. Inaug., Zurich. 1856,—a case where a perforating ulcer existed in the colon simultaneously with another in the stomach (quoted by Krauss); Lebert, Handb. der Prakt. Med. ii. 369. Dr. Dickinson, Trans. Path. Soc. 1867, has recorded a case of ulceration in the colon. I have seen two cases where intermitting hemorrhage from the colon rendered the diagnosis of ulcers in this part of the bowel extremely probable. Both were in females. Cases, where large alterations in the intestines resulted from embolism, are given by Panum, Virch. Archiv, xxv. See also on this subject Mr. Holmes's article, before quoted.

[4] Of 47 cases collected by Krauss, only 2 were situated in the lower horizontal part.

[1] Dr. Brinton, from a smaller number of cases, deduced that open ulcers and cicatrices are met with in about equal frequency. The result of the larger returns points to an interesting fact as regards the curability of the disease, which will be the subject of further remark.

[2] Mr. Curling has given a case where cicatrization of an ulcer in the duodenum after a burn was found commencing on the tenth day; another when it was completed at the eighth week; and Mr. Holmes has recorded one where cicatrization in the duodenum was completed within twenty-eight days after the burn from which it had probably originated.

[3] As in a case by Bürnhoff, quoted by Henoch, loc. cit. 143, where the pyloric and cardiac orifices were only 1¼ inch distant.

of the fundus ;[1] or where the whole organ may have been found reduced to the size of the intestine.[2] Strictures also of the orifices are by no means uncommon, though much more frequent in the pyloric than in the cardiac extremity.[3] Extreme degrees of stenosis are rare (only about once in 200 cases—Brinton). When affecting the pyloric orifice, they are usually attended with extreme distension of the whole viscus, and are associated sometimes with thinning, and at others with thickening, of its muscular coats, while in a third class this dilatation is limited to peculiar pouch-like formations in the pyloric portion.[4]

Similar constrictions have also been observed in cases where cicatrization has ensued in ulcers situated in the duodenum, the effects of which on the stomach are very similar to those produced by narrowing of the pyloric orifice. Sometimes, however, dilatations, for which an explanation is not easily afforded, have been seen immediately beyond and below the constricted part (Krauss). The contractions may also lead to peculiar bending and twisting of the intestine, and in one case, recorded by Frerichs,[5] to further consequences due to the thickening of the tissues external to the bowel, resulting in complete obliteration of the vena portæ.

The contractions of the cicatricial tissue, and the change thence resulting, are, however, not always necessarily attended with closure of the ulcer, which in some of the cases just quoted has still been found open.[6]

(*h*) *The extension* of the ulcer proceeds either by the destruction of the cicatricial tissue in its base and margins, or it may occur before this product has been formed. In the former case it is characterized by softening and liquefaction of the superficial layers of the base, while at the edges, where it is taking place, the thickened mass disappears, and the border presents the same sharply-cut limitation which characterized the first stage of the disease. In some instances this may be found affecting only part of the circumference, and thus affording a criterion of a return of the destructive process in an ulcer of old standing.

During its progress the larger vessels of the stomach are not unfrequently opened, and prove one of the sources of the hemorrhage so frequently observed.

The rapid extension of an ulcer in the early stages of its formation is one of the most frequent causes of the accidents next to be considered.

(*i*) *Perforations* of all the coats of the stomach may be divided into two classes —namely, those in which an opening has ensued from its interior into the abdominal cavity, and those in which this event is prevented by adhesion to the surrounding viscera. The frequency with which the first-named of these events occurs has been calculated by Dr. Brinton, from 257 recorded cases of open ulcer, as being about equal to 13½ per cent. of all cases of ulceration ; but, as this average is based upon an estimate of the comparative frequency of cicatrization, which there is reason to believe is considerably below that really found, so it is not improbable that the actual proportion of the cases in which this accident occurs is less than Dr. Brinton was disposed to believe[1]; though, as Cruveilhier has pointed out, it is much more frequent in cases of simple ulceration than in those of cancer of the stomach.

The influence exerted by age and sex on this event, having been already alluded to, does not appear to require further discussion. A very important feature in determining the character and nature of this result is to be found in the position of the ulcer itself in the wall of the stomach and duodenum. When this is situated in parts where the amount of movement and distension is the least, and where adhesions are most easily formed to surrounding parts, the probability of the accident is considerably less as compared with the cases where opposite conditions prevail ;[2] and thus ulcers situated in the

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[1] In cases by Cruveilhier, Budd, and Brinton.

[2] For a case of constriction of the cardiac orifice, with great consequent diminution of the size of the stomach, see Drasche, Wien. Med. Wochensch. 1854, No. 67 (Müller).

[3] Jaksch, loc. cit.

[4] See two cases by Cruveilhier, Anat. Path., Liv. liv. xx. Also a case quoted by Brinton, Dub. Med. Journ. ii. 494.

[5] Dis. of Liver, Syd. Soc. Trans. i. 272.

[6] See also a case of contraction of the duodenum by a recent ulcer, Duchek, Prag. Viertel-Jahresch. xxxvii. 51, 1853.

[1] Of Willigk's 231 cases of ulcers and cicatrices, as before quoted, only six had perforated; and Dittrich in 106 cases only met with ten cases of perforation. It is probable, also, as Miquel has observed, that in collections of isolated cases a greater number of instances of perforation will be found, owing to the remarkable character of the event conducing to its publication, while those of simple ulcer are not so commonly thought worthy of being recorded.

[2] Of 191 cases of perforation of the stomach by ulcers collected by Dr. Brinton, 69 were on the lesser curvature, 55 on the anterior surface, 11 on the posterior surface, 9 at the pyloric extremity, 10 at the cardiac end, 4 in the middle of the organ, and "in no less than 24 there were two ulcers opposite one another on the anterior and posterior surfaces of the organ—the former being the site of the perforation, while the latter was in most instances firmly adherent to the pancreas." It is interesting to compare these returns with

anterior wall of the stomach and on the lesser curvature are more liable to perforation than those in the posterior wall and the greater curvature; while, of the duodenal ulcers,[1] those situated in proximity to the head of the pancreas possess almost an immunity from this event.

Precise figures regarding the condition of the ulcer at the time of perforation are wanting; but, though the event is very frequent in those of old standing, there yet seems reason to believe that it is comparatively more so in the early stages of the disease, and before the protective thickening which subsequently ensues has had time to form. It seems not impossible that the depth to which the tissues are primarily affected by the process which gives rise to the slough, in which the ulcer often appears to originate, has no small influence in accelerating or retarding this event.

When it occurs in those of recent origin, or when there are no adhesions to neighboring organs, the peritoneal covering gives way after the previous formation of an ashy-gray slough, the final yielding of which is generally determined by distension of the stomach, or by the effort of vomiting. The external opening is usually considerably smaller than the inner surface of the ulcer; its edges are generally sharp and well defined, like those of the rest of the ulcer, but sometimes they may be slightly ragged from the final rupture of the necrotized tissue. They are never, however, so ragged and thinned, nor do they present the same pulpy and transparent appearance as is seen in the case of perforation by post-mortem solution, from which the perforation is further distinguished by the characters of the alteration of the mucous membrane in the latter.[2]

When adhesions have formed to neighboring organs, or when protective thickening has occurred in the sub-peritoneal tissues, the future progress of the ulcer is subject to many variations. Thus, it may deeply invade the tissue of the liver, spleen, or pancreas, giving rise to extensive hemorrhage from their vessels;[1] or deep fistulous openings may form into the interior of these organs, in which also, in some cases, large abscesses may be found communicating with the ulcer; while, in the case of the liver, secondary abscesses are by no means uncommon.[2] In other, but rarer instances, perforations may occur in the diaphragm,[3] and the ulcer may give rise to pleurisy or to gangrenous inflammation of the lung, or may communicate with the bronchi; or perforations may ensue into the transverse colon,[4] or externally through the anterior wall of the abdomen.[5] Other events which have been recorded are erosions of the pancreatic[6] and biliary ducts, and sometimes, in the case of duodenal ulcers, the ducts

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those of Jaksch relative to the comparative frequency of the sites of adhesion. These occurred in 22 out of 57 cases of ulcer, and in 15 they were between the posterior surface or lesser curvature of the stomach and the pancreas; in 5 between the pyloric portion or lesser curvature and the liver; while in one only there was adhesion to the mesentery, and, in one, to the spleen.

[1] Krauss states that, of 16 cases of perforation of the duodenum from this cause, in 12 the event had occurred in ulcers situated in the right wall of the upper horizontal portion.

[2] Cases are, however, recorded where the perforation took place, not at the seat of the ulcer, which had caused stricture of the pylorus, but from rupture of the fundus of the secondarily dilated stomach (Siebert, quoted by Müller, p. 110). A somewhat similar incident in a case of cancer of the stomach is recorded by Andral, Clin. Méd. ii. 75.

[1] Opening of the portal vein by a duodenal ulcer has been recorded by Rayer, Archives Gén. vii. 66; Andral, Prec. Path. Anat. ii. 177.

[2] See some cases by Dr. Murchison, Path. Soc. Trans. xvii. 145.

[3] These, however, are generally caused by fistulous communications through adhesions with other organs, or with circumscribed abscesses. See cases by Dr. Habershon, Path. Soc. Trans. 1847–48, p. 252; Obs. Alimen. Canal, 1862, p. 82; Cruveilhier, Arch. Gén. de Méd. 1856, p. 155; also by Rokitanski and Jaksch.

[4] See a collection of the published cases of this nature in an able memoir by Dr. Murchison, on Gastro-Colic Fistula, Edin. Med. Surg. Journ. 1857–58. This perforation is much more frequent in cancer than in ulcer of the stomach; of 33 cases 9 or 10 only were from simple ulcer, 21 from cancer.

[5] Dr. Murchison has collected all the cases of Gastro-Cutaneous Fistula hitherto recorded in a memoir, Med.-Chir. Trans. xli. There is a striking contrast between these and Gastro-Colic Fistula in regard to the comparative frequency with which they are connected with simple and cancerous ulceration; for whereas the number of instances in which openings into the colon are associated with cancer greatly exceeds that in which they are caused by ulcers, Gastro-Cutaneous Fistula would appear to be nearly twice as frequently the result of simple ulcer as of cancer. This difference is probably due in part to the comparative rarity of simple ulcer "in that part of the stomach nearest the colon, whereas of simple ulcers ending in perforation a very large proportion is found in the anterior surface." Perforations externally caused by ulcer may be distinguished usually by the smoothness of the opening, while those from cancer are ragged and villous through the extension of the growth in the skin.

[6] Rokitanski; also Dittrich, Prager Viertel-Jahresch. xiii. 124.

have been found either in a state of suppuration,[1] or obstructed, thus giving rise to jaundice,[2] or even to bursting of the gall-bladder;[3] while, in other instances, perforation of this latter structure by the ulcer has been noticed;[4] in others the stomach has been so bent upon its axis, as to form a second direct communication with the duodenum through the adhesion and perforation of their walls thus brought into apposition, the pyloric ring remaining, in some cases, open and bridging the newly-formed aperture.[5]

(*k*) *Escape of the contents of the stomach into the cavity of the abdomen* is almost invariably followed by more or less general peritonitis,[6] associated with tympanitic distension, which sometimes proceeds to an extreme degree, owing to the escape of air through the opening in the stomach or duodenum (Abercrombie).

In other cases, however, where, as Dr. Brinton observes, a gradual filtering of the gastric contents has taken place through a small opening in its wall, or through incomplete adhesions, and particularly through those which are formed between the stomach and omentum, circumscribed abscesses, sometimes of considerable size, and communicating with the ulcer, may be formed. Their boundaries are then variously constituted by adhesions between the ulcer and the anterior wall of the abdomen, or with the diaphragm, liver, colon, pancreas, or spleen, which latter organs may be sometimes partially or completely destroyed; or the abscesses may be limited to the cavity of the small omentum, a variety of which Dr. Brinton has collected twenty instances. Such abscesses may be more or less permanent, but the adhesions may again give way; and this event is then followed by more general peritoneal inflammation.

[1] Förster, Würzb. Med. Zeitsch. 1861, ii. 158.

[2] Krauss, p. 21.

[3] Herzfelder, Wiener Zeitsch. 1846, p. 23 (Krauss).

[4] Dr. Barker, Lancet, June, 1850, 776. Also Long, loc. cit. See also a case by Chomel (Andral, Prec. Path. Anat. ii. 116), where there was a fistulous communication between the duodenum, gall-bladder, and colon.

[5] Rokitanski, loc. cit. Cruveilhier, Rev. Méd. iii. 36. Dittrich, Prag. Viertel-Jahresch. xiii. In the latter case the communication took place through the pancreas.

[6] A remarkably exceptional case is recorded by Bardeleben, in which, though the patient lived twenty-four hours, and purgative medicines, together with other contents of the stomach, were found in the peritoneal cavity, there were no signs of general inflammation of its lining membrane. Virch. Archiv, v. 250.

In some cases where ulcers of the duodenum have opened into the loose cellular tissue boundary its posterior wall, the abscesses resulting have passed upwards through the mediastinum towards the neck,[1] or have opened outwards between the sixth and seventh rib on the right side, or, posteriorly, at the shoulder-blade.[2]

(*l*) *Hemorrhages* from the ulcer require a short separate consideration.

Cruveilhier[3] divided them into slight, moderate, and excessive, and pointed out that those of the two first classes came from the smaller arteries and veins of the mucous and submucous tissue, which, when examined under water, can be seen either eroded and obstructed by recent and easily detached clots, or closed by more firmly attached coagula. Copious hemorrhages may, however, sometimes be determined by venous congestion, since in some cases of this nature no other source has been found for the blood effused than varicose, dilated veins in the mucous membrane of the stomach.[4] The tendency is increased by hyperæmia, however originating, and especially by that occurring during the digestive act. It is probably also in this latter cause that an explanation must be sought for the cases where hemorrhage has been increased or caused by moral emotions[5] or by the menstrual period.[6]

Larger hemorrhages most commonly arise from the perforation of vessels of considerable size in the deeper coats. This event is indeed usually prevented by the coagulation of the blood in their interior, and by the resistant character of their walls; and it is by no means uncommon to find an obstructed vessel in the floor of an ulcer, in cases where no considerable hemorrhage has taken place during life. The ulceration of the obstructed vessel, nevertheless, may proceed beyond the point to which the protective thrombosis has extended. In some cases extensive hemorrhage has taken place in the early stages of ulceration, but in others the whole ulcer has been found cicatrized except at a point where an eroded artery,

[1] Förster, Würzb. Med. Zeitsch. 1860, ii. 162 (Krauss).

[2] Gross. El. Path. Anat. 532. Also a case by Dr. Stretton, of Worcester, Lond. Med.-Phys. Journ. vol. lx. p. 43. In the latter instance there were openings in both the last-named situations, and food passed through the fistulous opening between the ribs five minutes after it had been taken.

[3] Archives Gén. 1856.

[4] Cruveilhier, Anat. Path., Liv. x. Also Frerichs.

[5] Ib., Liv. xx.

[6] Ib., Liv. xx.

giving rise to fatal hemorrhage, projected into its floor.[1]

Another source of both the larger and also of the smaller hemorrhages is to be found in the penetration of the vessels of adjacent organs with which the ulcer has formed adhesions, and among these the splenic artery, which in its tortuous course often comes in contact with the stomach, affords a large proportion of instances of hemorrhage. Perforations are, however, recorded of the portal veins and of the hepatic artery from duodenal ulcer.

When, on the other hand, hemorrhage ensues from the main arteries of the stomach, it usually proceeds from those situated in the larger and smaller curvatures, and especially from the superior pyloric or coronary artery.[2] Moreover, as Miquel has also remarked, the presence of a large vessel at the base of an ulcer affords, by its resistance to the ulcerative process, a certain protection against the occurrence of perforation.

(*m*) *The condition of the mucous membrane* of the stomach offers also certain varieties. In many cases it is found perfectly healthy; in others, polypoid vegetations, or extravasations and hemorrhagic erosions, may be found around the margins of the ulcer; signs also of chronic or recent catarrhal inflammatory action are not unfrequent. These latter are, however, most common when constrictions have occurred in the pyloric or duodenal portions of the canal. The appearances characteristic of these changes, and also the varicose dilatation of the vessels occasionally observed, do not, however, require further description in this place.

Pathology and Pathenogenesis.—While some observers attributed these ulcers to inflammation, and others, as Cruveilhier, have expressed themselves unable to explain their origin, Rokitanski separated them from the class of ordinary inflammatory ulcerations, and declared that their point of departure was from a necrosis of the mucous membrane and subjacent tissues. Virchow[1] advanced the next step in this direction, by stating that the primary condition for their formation was an arrest of the circulation through a sufficient depth and area to permit the solvent action of the acid gastric juice to be exerted on the tissues deprived of the protective action of the alkaline blood. This view has received a direct confirmation from Dr. Pavy's[2] experiments on the effects of the arrest of the circulation in the stomach, which have shown that this event is invariably followed by the solution of the coats of the organ, proceeding in some instances to complete perforation; and it is still further corroborated by the case before quoted, where hydrochloric acid swallowed had given rise to an ulcer proving fatal by a perforation of the coronary artery.[3]

If this opinion be admitted as affording a probable explanation of many, if not most, of these cases, it follows that any causes capable of producing such an event may be competent to give rise to the ulcer in question; and among the most frequent of these appear to be extravasations of blood into the tissues of the stomach, to which a preponderant influence in this direction was first attributed by Rokitanski.

It appears, however, to be necessary that such extravasations should extend deeply, and occupy some considerable area, and that the minor petechial ecchymoses resulting from capillary hemorrhage on the surface, and to which the name of hemorrhagic erosions has been given, are, as a general rule, incapable of producing this effect, since the protective influence of the circulation is not, in these cases, sufficiently withdrawn, to permit of the action of the gastric juice extending deeply into the subjacent tissues.

Virchow states as his opinion, that the most frequent causes of this arrest of the circulation are obstructions of the arteries through embolism, extravasations through obstructions of the portal vein, fatty degeneration of the coats of the arteries, or even the diminished calibre of the vessels, sometimes met with in chlorosis, or extravasations caused by violent movements of the stomach in the act of vomiting.

The possibility of the direct production of these ulcers through embolism has been demonstrated by Panum's experiments. The immediate effect of the obstruction of the arteries thus produced was seen in

[1] Cruveilhier, Anat. Path., Liv. x. Also Boullay, Schmidt's Jahrbücher, vol. lxx. p. 185 (Miquel).

[2] Hence there is a certain contrast between the liability to perforation and hemorrhage determined by the anatomical position of the disease in the walls of the stomach, since ulcers situated on the anterior surface, from which, as has been seen, perforation is most likely to ensue, rarely invade in their progress any of the larger vessels, whose branches are only sparingly distributed to this portion of the organ. Thus, of 52 cases of fatal hemorrhage collected by Dr. Brinton, the ulcer giving rise to it was in 24 instances situated in the smaller curvature, in 17 on the posterior surface, in 6 on the pyloric extremity, and in 2 only on the anterior surface.

[1] See Handb. der Spec. Path. Therap. i. 256; Archiv, v. 362 et seq. Wien. Med. Woch. 1857, pp. 498, 499. Gesammelte Abhandlungen, p. 706.

[2] Phil. Trans. 1863. A Treatise on the Function of Digestion, 1867.

[3] Note 1, page 85, last column.

extravasations into the submucous and mucous tissues, which were followed by ulcerations in these parts, having all the characters above described;[1] and Müller[2] has equally shown that very similar results may be produced by ligature of the vena portæ.[3] These observations would also explain some cases when acutely produced recent ulcers of the stomach and duodenum have been observed in pyæmic or metastatic affections, and possibly in the puerperal conditions to which allusion has been already made.[4]

It has been remarked by Virchow that both the shape and also the most common positions of these ulcers point in many cases to their arterial origin, and that the conical form, with the base at the mucous surface, corresponds to the ramifications of the capillary branches spreading outwards from a main trunk, which has been obstructed in the deeper tissues, and thus resembling precisely the results of arterial embolism in other parts where similar appearances are seen.

The appearances of extravasations found in connection with some recent ulcers, which have been before alluded to, seem also in a great degree to confirm this theory of their hemorrhagic origin. It may further be noted that many of the causes to which their production has been attributed are such as would coincide with this opinion, through their inconstancy in this respect is easily explicable, when we consider that though the tendency of the majority is to produce congestion of the stomach and intestines, yet that this may proceed to a marked degree without necessarily involving the occurrence of such extravasations as are capable of giving rise to extensive or deeply-spreading necrosis of the coats of these organs. Some clue may thus be gained to their frequent appearance in connection with disturbances of the menstruation, which are known to give rise to great disorder in the functions of the stomach. This is further evidenced by the hemorrhage from this organ, which occasionally replaces that from the uterus, and which must necessarily have been preceded by an extreme hyperæmia, not only of its lining membrane, but also of all the vessels supplying it; while the not infrequent coincidence of the disease with the puerperal state may be attributed either to conditions of congestion, or, probably in many, to embolism associated with pyæmia.

A similar origin may also with great probability be ascribed to duodenal ulcers commencing after burns of the skin, though it is possible that the direct mechanism of their production may be by means of embolic processes rather than through simple congestion. Their size in these cases, however, appears to require further explanation, since the possible implication of Brunner's glands, suggested by Messrs. Bowman and Curling, does not appear completely to elucidate their peculiar frequency in this position under these circumstances as compared with their relative rarity under other conditions. The appearances of recent extravasations observed in several recorded cases of this nature may very properly be placed in juxtaposition with Rokitanski's observations on the frequency of hemorrhage from the lower portions of the intestinal canal in connection with similar causes, as pointing to their origin in intense congestion leading to rupture of the vessels.[1] A similar explanation may thus be afforded of an instance recorded by Cruveilhier,[2] when the symptoms of ulceration followed an attack of cholera; for although in this disease hemorrhage is more common in the intestines than in the stomach, yet extravasations in the latter are also occasionally observed.[3]

Dr. Copland's independent testimony[4] confirms Virchow's opinion that extravasations having a similar result may arise through atheromatous degeneration of the coats of the vessels of the stomach. Frerichs, also, in a case where an ulcer of the stomach followed the obstruction of the gall ducts,[5] has pointed out that

[1] Virchow's Archiv, xxv. p. 491 et seq.

[2] Loc. cit. p. 272 et seq.

[3] It is remarkable that cirrhosis of the liver does not more frequently give rise to ulcer of the stomach. Frerichs only gives three cases of the latter disease associated with disease of liver. Only one of these was associated with chronic atrophy. Förster gives a case of ulcer of the duodenum associated with cirrhosis, Würzburg Med. Zeitsch. 1861, ii. p. 165 (Krauss). A case is recorded by Gunsburg, Arch. Phys. Heilk., where the determining cause of the ulcer appeared to be the obstruction of a vein in the stomach itself.

[4] See a case by Buhl, Bericht über 280 leichen Oeffnungen, Henle and Pfeuffer's Zeitsch. Rat. Med. 3d ser. viii. 1857, p. 34, where there were recent perforating ulcers of the duodenum and intestine in a case of pyæmia associated with parotid abscess. See also a case of gangrene of the intestine from embolism. Gaz. Hebdom. 1862, Oct. 3.

[1] Mr. Erichsen had previously pointed out only the probability of the extreme congestion of the gastro-intestinal canal acting as the cause of these lesions.

[2] Rev. Méd. 1838, iii. 32. Path. Anat., Liv. xx.

[3] See author's report on Stomach and Intestines in Cholera. Path. Soc. Trans. 1867. Also Cruveilhier, Path. Anat., Liv. xiv. Also Buhl, Report of Munich Commission on Epid. of Cholera, 1854, p. 500.

[4] Med. Dict. vol. iii. pt. 2, p. 919.

[5] Dis. Liver, Syd. Soc. Trans., by Murchison, i. 137.

Kölliker and Müller[1] observed the disease in the duodenum in cases where the common bile duct had been ligatured, and where also calcareous matter was deposited in the branches of the cœliac axis and in those of the mesenteric arteries.

Our knowledge of other possible causes of the disease must be considered as yet imperfect.[2] It may be questioned whether inflammatory states often, if ever, exist in the stomach to a degree sufficient to act in a manner similar to the conditions which have now been described. It appears improbable that the follicular ulcerations proceeding from the solitary glands of the mucous membrane often extend beyond the area occupied by these structures, though the distribution of anatomical elements of a lymphatic character has been shown, by Dr. H. Jones's and the author's observations, to extend more widely in the mucous and submucous tissue, than has been sometimes supposed.

Another more likely cause, though of rarer occurrence, is found in those cases where profuse suppuration takes place in the submucous tissue, the effects of which are extremely likely to arrest the vascular supply of the mucous membrane.[3]

It is also not impossible that excessive secretion, or excessive acidity of the gastric juice, particularly in the absence of food in the stomach, as when the secretion is excited by alcoholic drinks, may also give rise to ulceration, since it has been shown that an excess of acid introduced into the stomach may produce similar effects.[4]

However originating, the peculiar tendencies to extension and perforation seem to be especially communicated to these ulcers by the action of the gastric juice; for though ulcerations of the lower portions of the intestines are very common in other diseases, perforation is a very rare event, unless caused by the direct necrosis of the new formations of tubercle or typhoid. It is also worthy of remark that ulcers of the kind now described are, with rare exceptions, limited in their appearance to the upper part of the canal, where the solvent power of the gastric juice is still active, that of the intestines on protein substances being very inferior in this respect; and though the causes of ulceration may affect equally the whole canal, these special effects are only produced by the additional influence thus exerted.

Symptoms.—The symptoms which are characteristic of this disease have been enumerated as pain, vomiting, hemorrhage, disturbances of the digestion, and alterations of the secretions of the stomach. The whole of these are not, however, constantly present in any single case, and there is a considerable diversity observed in their relative predominance, and in the order in which they may appear; while in a certain number, and especially in those which run a rapid course, leading to perforation, the disease may have been entirely latent until within a few hours of a fatal issue.

Pain may be regarded as the most constant of these symptoms, so much so that in its absence the diagnosis of gastric ulcer would scarcely be justified during life. It is often the earliest in its appearance, though in some recorded cases it has been preceded, for a longer or shorter period, by disturbances of the digestion, and also by pyrosis, or by excessive secretion of acid supervening immediately after meals.

There are considerable differences, however, observed in its character, intensity, duration, and mode of accession, which appear to be in some measure explicable by the extent of the ulcer, by the implication of large nerve trunks, and by the manner in which, from its position, it is affected by the movements of the stomach.

It seems, however, not unimportant to observe that the varieties of pain described, though not in all cases absolutely distinguishable, may be divided into two classes. The first of these is more or less constant, and its characters are described as those of wearing, burning, boring, but rarely (Brinton) sharp and lancinating; often confined to a very limited space at the epigastrium, but felt also in the back behind the lower dorsal and first lumbar vertebræ, and between the scapulæ, in both of which latter situations, as remarked by Cruveilhier, the pain may sometimes exhibit a greater intensity than at the epigastrium. It is sometimes felt also towards the hypochondria or umbilicus, and deviations in these directions have been found by Dr. Brinton to accord with corresponding variations in the site of the ulcer. It is generally increased, and only in rarer cases relieved, by taking food. The second variety tends to occur in paroxysms, and is felt over a more extended area. It is of intense severity, so

[1] Würzburg Verhand. vi. 474.

[2] An experiment of Frerichs, Dis. Liver, i. 187, would lead to the question whether disturbances of the circulation or of the nutrition of the stomach through derangement of the nervous supply may not occasionally produce this effect. He found an ulcer of the stomach in a cat after division of the splanchnic nerves and of the cœliac axis.

[3] See Dittrich, quoted by Brand, Ueber Stenosen des Pylorus, Diss. Inaug. Erlangen, 1851; also Reynaud on Gastritis Submucosa, Bull. Soc. Anat. 1861; 2d ser. vi. 89, cases quoted of this possible origin of ulcers.

[4] See notes 6 col. 1, and 1 col. 2, p. 85.

as sometimes to cause fainting, or even convulsions (Bamberger). The attacks, which are usually described as cardialgia, are often attended with strong abdominal pulsation, probably due to a reflex paralysis of the muscular coats of the abdominal aorta.

The more constant pain, which in many cases, when exacerbations are absent, consists rather in a sense of uneasiness than of more acute suffering, seems to be directly referable to the existence of the ulcer, and is felt with a severity proportioned to the depth to which it has extended, and especially to the implication of the peritoneal surface of the organ. The paroxysmal form is generally relieved by emptying the stomach of its contents by vomiting; hence in many cases it is probable that it is due directly to the irritating effects of food, and to the movements of the stomach caused by its presence, and also to distension by flatus, or to the generation of abnormal acids by fermentation, most of which causes act with greater intensity when adhesions have been contracted to surrounding parts.

These paroxysms have also been met with when large branches of nerves[1] have been invaded by the ulcer; and as their frequency and intensity have in some cases been found to correspond with the occurrence of hemorrhage, and also with the size of the ulcer, it is not improbable that they are in some measure connected with its extension. They are also not unfrequently caused by moral emotions, and by exposure to cold and wet, or by bodily exertion; so that, although in the majority of cases they are explicable by the physical condition of the stomach, a certain class remains in which the paroxysmal character must be referred to special conditions affecting the nervous system; and some instances are recorded by Traube[2] when during these attacks there was hyperæsthesia or anæsthesia of the cutaneous surface of the thorax, and even pain extending down the arm.

Complete intermissions of pain, sometimes extending over a considerable period, are occasionally observed; or there may only remain in these intervals a slight degree of epigastric uneasiness, somewhat increased by taking food. It is a not improbable inference that the relief thus experienced may be due to periods when a cicatrization of the ulcer is taking place, since the converse condition, viz., its extension, appears to be associated with periods of aggravation.

Aggravations of the pain have been observed to precede the menstrual period, and to diminish in intensity on the establishment of the discharge.

The pain is almost invariably[1] aggravated by pressure, and there is frequently such a degree of epigastric tenderness that the slightest pressure from the clothes, or the gentlest touch by the hand,[2] becomes unendurable. The amount of tenderness depends in some degree on the position of the ulcer, those situated on the posterior surface being less affected by manipulation. In some cases an increase of the dorsal pain has been observed to follow pressure on the epigastrium.

The effect of food is also most invariably to bring on or to aggravate pain already existing. The period at which the pain follows its ingestion varies in different cases, and in some it has been observed to depend on the site of the ulcer, those in the neighborhood of the cardia or fundus being often more speedily followed by this symptom than when the disease is situated in more distant parts of the organ. It is seldom, however, that its appearance is long delayed; and in fact the early supervention of this symptom under these circumstances is one of the most valuable diagnostic criteria of the nature of the complaint.

When pain occurs at longer intervals after food, as after a lapse of one or two hours, it is in all probability attributable either to flatulent distension of the stomach, or to excessive acidity, or in some cases to the position of the ulcer at the pyloric orifice, or in the duodenum, when the passage of the food from the stomach brings on an aggravation of suffering. It does not appear, however, that this difference can be depended upon with any certainty as a test of the position of the ulcer, for the symptom may be early excited, whatever the site of the disease; and secondly, food passes out of the stomach, though in comparatively small quantities, at a very early period after its introduction.[3]

[1] Habershon, loc. cit. 129, 131.

[2] Deutsche Klinik, 1861, p. 63.

[1] Exceptional cases are recorded by Abercrombie, Henoch, Cruveilhier (Path. Anat., Livr. x., xx.), and by Miquel (Van Deen, Schmidt's Jahrbücher, li. i. 39), where strong pressure on the front of the abdomen gave relief. In one of Cruveilhier's cases the ulcer was situated on the posterior wall, in another on the anterior surface. Miquel advances in explanation of these cases the probable hypothesis, that the mitigation thus experienced, which was particularly observed during paroxysmal attacks, may be due to the restraint thus exercised on the movements of the stomach.

[2] The necessity of caution in this proceeding, to avoid rupture of the stomach, requires to be insisted upon.

[3] See Dr. Stretton's case, before quoted; also Busch's observations on a case of duodenal fistula. Virchow's Archiv, xiv.

Variations in the intensity of the pain have been observed to depend on the position assumed by the patient being such as to free the ulcer from contact with the contents of the stomach.[1] This test also is not, however, infallible, as in some cases the severity of the pain, whatever the side of the ulcer, is unaffected by posture, and in some it has even been relieved by the patient lying or pressing towards the seat of the disease.[2]

Though no small share in the production of the pain by food is probably due to the movements of the stomach and to the acid secretion excited by the food, yet it is found that in the majority of instances its severity is increased by indigestible and stimulating substances, and by hot liquids. [Sugar is rather particularly apt to give pain.—H.] Some very exceptional cases are, however, recorded, not only in which bland articles of diet have given relief—a more common occurrence—but also where stimulants, and even brandy, have sometimes mitigated severe pain.[3]

Vomiting stands next to pain in order of its frequency and importance. It is, however, sometimes absent throughout the whole course of the disease, while in other cases even the blandest articles of food are immediately rejected. Ulcers situated in the neighborhood of the pylorus seem to be more constantly associated with this symptom than those found in other parts. In some cases it appears as a mere regurgitation of the food, without much nausea or straining; and it usually attends and sometimes terminates the paroxysmal attacks of pain,

The matters vomited vary; food is returned altered in proportion to the time during which it has remained in the stomach. Acid or neutral fluids are also brought up, sometimes in considerable quantities, either independently of food, or, when accompanying it, far exceeding the amount of fluid which has been swallowed. In other cases evidence of the destruction of adjacent organs has been found in the vomited matters, as liver structures[1] and the elastic fibres of the spleen.[2]

The sarcina ventriculi is occasionally, but not frequently, seen in the vomited matters.

Hemorrhage is generally revealed by vomiting; when, however, small quantities of blood are effused, it is possible that they may often escape notice, and therefore the frequency of this symptom cannot be accurately estimated. Of larger hemorrhages, Miquel has found fifteen instances in ninety-one cases, while Brinton thinks that they occur in about one-third of all the cases of ulcer. In a case recorded by Cruveilhier[3] the hemorrhage from the stomach frequently recurred at the menstrual periods, and sometimes replaced this discharge.

The characters of the blood brought up differ with the amount effused, and also with the rapidity with which it has escaped. Smaller quantities have usually a black or coffee-ground appearance, which may only appear in striæ, or patches on the mucus or food by which they are accompanied. Larger hemorrhages poured out quickly from arteries of considerable size may, when vomited, still retain an alkaline reaction and arterial color; while in other cases the blood is coagulated, and more or less blackened by the action of the gastric juice.

In some instances, however, none of the blood effused is vomited, but the whole escapes by the bowel. The blackened and tarry appearance which the evacuations present under these circumstances, and the distinguishing features of its origin, will be hereafter described (see Hemorrhage). In a third class, the hemorrhage may at once prove fatal by causing syncope, without previous vomiting, and the cause of death may only be revealed *post mortem* by the distension of the stomach and upper part of the small intestines by large quantities of blood.

Certain prodromata may precede or accompany the hemorrhage. The chief of these are a sense of heat, pulsation, fulness, weight or load at the epigastrium. They are not, however, commonly prominent, and are frequently unmarked, and the expulsive act is rarely preceded by any long-continued nausea. The prostration which follows excessive bleeding is sometimes very serious and alarming. The patient may be completely blanched, and the slightest movement may threaten syncope. When this condition persists without vomiting, a sedulous examination of the stools is necessary, to avoid the possibility of overlooking a loss of blood which

[1] First observed by Dr. Osborne, Dub. Med. Journ. xxvii. 361. Dr. Brinton says that two-thirds of the cases which he personally observed exhibited a marked influence of posture on the pain.

[2] See Brinton, Ulcer of Stomach, p. 71. Also Chambers, Lond. Journ. Med. 1852, and Nasse, Schmidt's Jahrbücher, 72, who found an ulcer of the anterior surface relieved by a prone decubitus.

[3] See a case by Mr. Travers and Dr. Farre, Med.-Chir. Trans. vol. viii. Several cases of this kind, chiefly from foreign authors, are also quoted by Miquel, loc. cit. p. 16; in some of them the diagnosis of ulceration was verified by post-mortem investigation. See also Duchek, loc. cit.

[1] Miquel, loc. cit. p. 25.

[2] Sangalli under Virchow, Schmidt's Jahrbücher, 1854, iv. 45.

[3] Path. Anat., Liv. xx.

is still proceeding, but which is only revealed by such an investigation. Blood thus escaping by stool sometimes causes diarrhœa, at others, griping and colicky pains.

The digestion is liable to be influenced by various circumstances, which form very complex features in estimating the influence of this particular disease upon the functions of the stomach, and it is difficult to separate its derangements from the pain to which the mere contact of food with the surface of the ulcer gives rise. When the mucous membrane is but little affected, it may proceed almost unimpaired. The mere presence, however, of the ulcer generally brings with it conditions of derangement which are seldom without an unfavorable influence, through the effects of adhesions impairing movement, or through the direct influence of pain, or through the invasion of the nerves by the ulcer either directly impeding the secretion of the gastric juice, or giving rise to various abnormal alterations of its quality.

The evidence of this latter state is often the most prominent, and pyrosis of an acid or alkaline character may constitute for years the chief symptom present; but few cases escape without other dyspeptic derangements, and flatulence is a very common symptom. In other instances the digestion appears to be simply delayed, and to be attended throughout by a sense of epigastric load and uneasiness, and with eructations which are very liable to pass into vomiting. These symptoms are also largely influenced by the nature of the food taken; and though idiosyncrasies[1] exist, in this respect forming exceptions to the rule, they are usually aggravated by indigestible substances of all kinds.

When pyloric obstruction has been caused by an open or cicatrized ulcer, these symptoms are greatly aggravated. Nor does the healing of ulcers situated in other parts bring complete alleviation, as the contractions thence resulting may greatly interfere with the movements of the organ; and long persistent dyspepsia has been traced to this cause.

The appetite often suffers but little; frequently it is excessive and ravenous—a condition explicable in some instances by the loss sustained through vomiting, but in others probably to be referred to perverted innervation. When severe pain is present, it is often diminished. In some of these cases patients desire to eat, but fear to do so on account of the pain excited by food; in others a true anorexia is present.

The appearance of the tongue is probably influenced in no small measure by the condition of the mucous membrane of the stomach. In many cases it presents no deviations from that of health; in others it is more or less furred, or red and fissured. Sometimes during exacerbations of the disease it becomes aphthous (Abercrombie and Henoch). It may, however, be stated, that as a general rule it offers no distinct indications either of the presence or nature of the disease.

An excessive secretion of saliva,[1] in which the sulphocyanide of potassium is remarkably deficient (Bamberger), has been not unfrequently observed.

Constipation is a very constant symptom. It is probably in some cases due in part to the vomiting; but some influence may also be ascribed to reflex impairment of the intestinal action from the presence of the disease: in other instances, as in one recorded by Dr. Budd,[2] it is directly due to adhesive peritonitis glueing the coats of the intestines together, a condition which can scarcely be supposed to exist without some degree of simultaneous muscular paralysis. In some cases the constipation has a tendency to increase the vomiting, which then may be relieved by acting on the bowels by means of enemata.

The general strength of the patient often suffers in an extreme degree in the later stages of the disease. When vomiting is a prominent symptom, and when hemorrhage and severe pain are superadded, a cachectic condition is induced, which it is exceedingly difficult, if not impossible, to distinguish, *per se*, from that of cancer. There is often the same earthy tint of skin: and in females, in whom the menstruation is disturbed, this may exist to a very marked degree. Others have after hemorrhage the waxy look of extreme anæmia; and the latter appearance is extremely common in young girls who are the subjects of the disease.

Cachexia, however, except when hemorrhage is present, does not usually occur early in the disorder; and when vomiting and hemorrhage only take place at a long intervals, both it and emaciation may be absent during many years in which the disease has, in all probability, existed.[3] Cases also are met with in which, though presenting very characteristic signs of the disease, no *external* appearance of departure from sound health is observable, while in others, which have run an almost latent course, the only symptom observed has been a gradually progressive emaciation.[4]

In other instances, as was observed by

[1] See some cases by Oppolzer, Wien. Med. Woch. 1851, where raw ham agreed well.

[1] Osborne, Dubl. Med. Journ. xxvii. 365.
[2] Loc. cit. 128.
[3] A case by Henoch, loc. cit ii. 122.
[4] Lees, Diseases of the Stomach, pp. 73, 74.

Jaksch, the disease appears to run an acute febrile course, with dull pain at the epigastrium, nausea, and vomiting, a loaded tongue, on which aphthæ are observed, with complete anorexia. The fever is more or less continuous; the skin is hotter than natural, and the cheeks are flushed. This condition, of which I have observed some instances, tends especially to occur during periods when pain has been more than usually severe. Its appearance may probably be accounted for either by the supposition of an inflammatory condition of the rest of the mucous membrane of the stomach, or, in the cases in which this symptom has appeared towards the close of life, when the patients are exhausted by the duration of the complaint, it may probably often arise from some intercurrent inflammatory action, and especially from pneumonia, which is found to be a common complication.[1] The frequency with which tuberculosis is met with in cases of the disease would also probably serve to explain the febrile reaction in such instances.

The frequency of the connection of amenorrhœa with the gastric ulcer has been treated of in the etiology of the complaint.

The symptoms of duodenal ulcer differ but little from those which are met with when the disease occurs in the stomach.

Pain is often a less prominent feature, its absence being explained by Dr. Budd to depend on the fact that this part of the canal is subjected to less movement than the stomach. It may, however, exist with the same severity, and with all the features which have been before described; and, as in the case before quoted, it has been known to occur when the stomach is empty.[2] It has been observed in some cases to be limited to the right hypochondrium, and to be associated with marked tenderness on pressure in the same region. In a case recorded by Mayer an excessive feeling of hunger was noticed.[1]

Vomiting is also said by Krauss to be less frequent, and when present it is generally associated with stricture of the intestine. It sometimes occurs in connection with attacks of cardialgia, when its explanation is probably to be found in a reflected irritation communicated to the stomach.

Hemorrhages, revealed by vomiting or by the state of the fæces, occur in about one-third of the recorded cases; and fatal cases, when death has taken place immediately by syncope, have also been recorded.[2]

The disease in this region also frequently appears to run a latent course, unrevealed by any symptoms beyond those of comparatively slight dyspeptic derangements, until fatal perforation suddenly occurs.[3]

Dr. Brinton has stated that diarrhœa is common in ulceration of the duodenum, and that it thus forms a contrast with the constipation observed when the stomach is the seat of the disease. Krauss, however, who appears to have collected the largest number of cases of this disorder, regards diarrhœa as being only an exceptional symptom, and says that constipation is the rule in the duodenal, as in the gastric ulcer.

The symptoms of perforation, both of gastric and duodenal ulcers, are almost invariably sudden in their invasion; but in a few cases, probably where perforation has been gradual, they have been observed slowly to increase in intensity; and a similar course is witnessed in instances accompanied by the formation of local abscess in the cavity of the abdomen.

In the first class, however, which forms much the largest number, they usually supervene after a full meal, or after some violent exertion, or after vomiting, or the effort at defecation.[4] They are ushered in with an intense pain in the abdomen; sometimes a sensation of tearing has been described (Dahlerup); rigors have also been noticed at the outset. Severe general abdominal pain follows, which is

[1] In the case before alluded to, where the ulcer was caused by the swallowing of hydrochloric acid, there was a second extension of the ulcer accompanied by a marked secondary series of pyrexial phenomena. A boy æt. 11 swallowed ℥j of "spirits of salt" on the 30th May. Admission to hospital on the 1st June, with pain in stomach and vomiting of blood-stained mucus. Pain and pyrexia, with a temperature not exceeding 100·4 Fahr., continued until June 5th. From this date the symptoms ceased, and the temperature remained normal until June 10th, when copious hæmatemesis occurred, followed by increased pain and tenderness. June 11th, temp. 99·2; June 12th, temp. 104·2; June 13th, temp. 101·2; June 14th, copious hæmatemesis, proving fatal within a few hours. There were adhesions of the stomach to the transverse colon and liver, but no other signs of peritonitis. This ulcer was situated about 1½ inches from the pyloric ring, and had perforated a large artery. No other condition could be found to account for the pyrexia.

[2] See also a case by Mayer, loc. cit. 106.

[1] The same was observed in Busch's case of duodenal fistula.

[2] Cas. Broussais, Duodénite Chronique, 1825, p. 65.

[3] See some cases of this nature by Dr. Budd. Also one by Dr. Murchison, Path. Soc. Trans. ix. 198.

[4] Bouillaud, Arch. de Méd. i. 534, cited by Andral. Pressure on the epigastrium, through leaning out of a window, is mentioned as a cause by Henoch.

greatly aggravated by vomiting or by severe retching. An intense degree of collapse is frequently associated with these symptoms; the face is pale and sunken, anxious, and hippocratic; the pulse small, rapid, and almost imperceptible; the limbs cold and tremulous; suppression of urine has been also observed,[1] and death may take place suddenly at this stage from shock.

If life is prolonged, the symptoms which follow are those of general peritonitis. The abdominal muscles are at first spasmodically contracted and drawn into knots (Crisp[2]); subsequently the abdomen becomes greatly distended from gas escaping into its cavity, and the percussion note is uniformly tympanitic. The liver is also pushed backwards, so that its dull resonance in front is replaced by a tympanitic percussion note under the ribs (Oppolzer). Respiration is entirely thoracic and sighing, the knees are drawn up on the abdomen, and the patient is afraid to speak or move through fear of increasing his sufferings: the abdomen is also intensely tender on pressure. If life is sufficiently prolonged, signs of an accumulation of fluid may be detected in the lower part of the cavity; but death usually takes place in a few hours, or at most after two or three days.

In other cases where circumscribed abscess has formed, the signs of general peritonitis may be wanting, and those of the localized inflammation may be more or less distinct, in the form of limited pain and tenderness, associated sometimes with circumscribed enlargement, and even with a distinct fluctuating tumor. In these cases symptoms of general peritonitis may follow at later periods, owing to the escape of the contents of the abscess into the abdominal cavity. Perforation of other structures may be shown by a fistulous communication with the external surface, or by signs of empyema or pneumothorax, or by a large expectoration of puriform fluid, associated with more or less hæmoptysis, or by the physical signs of a cavity, or of circumscribed gangrenous pneumonia at the base of the lung, or, when the colon had been invaded, by the passage of undigested matter by stool soon after food has been taken, or by fæcal vomiting,[3] and a fæcal odor of the breath.

Course and Duration.—Both the course and duration of these ulcers are, as will be seen from the foregoing description, very variable. Two main classes may, however, be appropriately established; one, when the disorder is of short duration, tending either to an early cicatrization, or to a rapidly fatal termination by perforation or hemorrhage, and another, when the disease is of almost indefinite duration, lasting with intermissions during many years,[1] and occasionally interrupted by severe attacks of pain, vomiting, or hemorrhage — variations which may probably be explained by the occurrence of imperfect cicatrization alternating with renewed extension of the ulcerative process.

Prognosis. — Cruveilhier's statement that "the simple ulcer of the stomach tends essentially to a cure," is fully confirmed by the number of cicatrices found *post mortem* as compared with that of open ulcers. Additional support is afforded to a hopeful prognosis by recorded cases,[2] where, after long persistence of the symptoms of ulcer, these had subsided, and the presence of cicatrices has been revealed by autopsies made after death from other causes, and sometimes after long intervals of time. It cannot, however, be denied that the dangerous nature of the events which may occur during its course contribute to impart to the disease a character of extreme gravity.

Even the periods of comparative immunity from the more urgent symptoms by no means, in all cases, justifies the conclusion that the disease is at an end, for intermissions of these followed by renewed exacerbations are not uncommon. The hope of a permanent cure diminishes also in proportion to the length of time which the disease has lasted; the cicatrization in these cases being impeded by thickening of the margins of the ulcer, by the implication of other organs, and by the inversion of the mucous membrane into the funnel-shaped excavation.

When a cure is not effected, the pro-

[1] Dr. Sedgwick, Lancet, June 15, 1867.

[2] Also noted by Cruveilhier.

[3] This has been recorded in only one case by Abercrombie.

[1] Dr. Brinton quotes cases where evidence of continuous disease had lasted in one 35 years; in two, 30; three or four, 20; in four or five, 15; and in several, 10, 7, 5, and 4 years. Dr. King Chambers has also recorded a case (Indigestions, p. 185), where the patient died of ulcer of the stomach thirty years after the first hæmatemesis. Other instances are given by Cruveilhier and Dr. H. Jones.

[2] Cruveilhier, Archiv. Gén. 1856, p. 160. The case of the celebrated anatomist Beclard, given by Billard, De la Membrane Muqueuse Gastro-Intestinale, 1825, p. 558, is an interesting example of this fact. After severe intellectual labor he suffered from pain at the stomach and vomiting; but by a careful diet, local bleeding, and counter-irritation these ameliorated, though only gradually. After his death, many years later, the cicatrix of an ulcer was found in the small curvature of his stomach.

gress to a fatal termination is generally slow, sometimes extending through periods of many years; the patient dying finally of exhaustion and marasmus induced by the pain, vomiting, hemorrhage, and disturbances of digestion.

In other cases, as has been before described, life may be immediately cut short by hemorrhage or perforation. The risk of the former of these accidents is not very considerable, amounting, according to the estimates of Dr. Brinton (with which those of Müller and Miquel pretty closely correspond), only to about $3\frac{1}{4}$ to 5 per cent. of all cases.

The frequency of perforation has been stated to be open to discussion; but, under the most favorable estimates, the danger of death from this cause is considerably greater than that from hemorrhage. The prognosis in this respect is liable to be influenced by the age of the patient, for it has been seen that with advancing years the liability to this event is considerably diminished. The risk in the early periods of life appears also to be greater in the female than in the male sex.

Even, however, in the commonly fatal event of direct rupture of the stomach and escape of its contents into the cavity of the abdomen, life need not be absolutely despaired of, since cases have been brought forward which prove that recovery may take place even after this has ensued.[1]

After the formation of an external fistula through the abdominal parietes, life in some cases seems to be prolonged without much suffering, and cases of cure by closure of the external opening have been recorded.[2]

Even with the completion of the process of cicatrization the cure of the patient can hardly be said to be perfect. The cicatrix by involving branches of nerves may be the source of long-continued pain, and probably also of derangements of the gastric secretion, while alterations in the shape of the organ, arising from the healing of large ulcers seated in its central portions, may often, by interfering with its movements, prove the source of permanent disturbance of the digestion. The evils resulting from contractions, from the same cause, of the pylorus and duodenum will be again alluded to. Nor can the risk of a renewal of the ulcerative process in the tissue of the cicatrix be lightly passed over, since many cases are recorded in which the disease has returned in its original seat, and ended in perforation or hemorrhage after the ulcer has been apparently closed, or, at least, after all the more urgent symptoms had ceased for years; a liability which induced Cruveilhier to express the opinion that both these accidents are more liable to occur "consecutively,"—*i. e.*, by the erosion of the cicatrix,—than "primitively" during the period of the formation of the ulcer.[1]

Nor can another liability be forgotten, of which proof is afforded both by the multiplicity in some cases of open ulcers, and by the frequent coexistence of these with cicatrixes,—viz., that the causes inducing the disease tend to remain in operation in the same individual, and, that though one ulcer may have healed, another may be formed and may prove fatal at a subsequent period.

Diagnosis.—The symptoms of ulcer of the stomach require to be distinguished from the severer forms of neuralgic affection, from some cases of chronic inflammatory action, from cancer of the stomach, and in some cases from colic. The distinguishing features of the affection are severe localized *persistent* pain, intensified in paroxysms, aggravated by food, and associated with tenderness on pressure, with vomiting, and with hemorrhage, disclosed either by vomiting or by stool.

Without the simultaneous occurrence of the greater number of these symptoms, the diagnosis of ulcer must often remain somewhat uncertain, and it is the combination now enumerated which must mainly serve as the basis of diagnosis.

Some of them, however, are more frequent than others, and localized pain aggravated by food and associated with localized tenderness is sufficient to excite the gravest suspicions of the nature of the disease.

In another class, however, persistent

[1] See a most interesting case of this nature by Dr. Hughes and Messrs Hilton and Ray, Guy's Hosp. Rep. 2d Series, vol. iv., of a girl in whom all the symptoms of perforation occurred, but ended in recovery. At a later period, after a meal which had greatly distended the stomach, the same patient was again attacked in a similar manner, and death ensued. At the autopsy two open ulcers were found in the stomach, one of which had perforated. There was a cicatrix of a former ulcer, and old adhesions existed between the stomach and adjacent viscera, and also between coils of the intestine, giving evidence of a previous attack of peritonitis. Miquel relates a similar case of recovery, but not verified by post-mortem examination. Another of the same kind is given by Dr. Hughes Bennett, Clin. Méd. 487.

[2] Dublin Journal, vi. 148, from an American source; Western Journal Med. Phys. Science, 1834. Middeldorp has also almost completely succeeded in closing a gastric fistula by a plastic operation, Canstatt's Jahresb. 1859, iii. 187, Brit. For. Rev. Oct. 1860.

[1] Arch. Gén. p. 160.

dyspeptic symptoms associated with extreme degrees of acidity, unaffected by food or by treatment, have proved the sole symptoms of the disorder, which has ended fatally by perforation.[1]

The diagnosis from *chronic catarrhal inflammation* is as a rule only difficult in those cases of the latter disorder which are attended with hæmatemesis from congestion. The distinctive features of this form of disorder have been already described (see Chronic Catarrh, pp. 75, 79). The other forms of chronic catarrhal inflammation are rarely associated with distinct or severe gastric pain. Vomiting also is a much rarer symptom. They are, further, usually associated with more marked symptoms of dyspeptic derangement, with a more loaded tongue, and with more thirst, malaise, and pyrexia than are commonly observed in cases of ulcer.

The chief features which distinguish *ulcer* from *neuralgic affections* of the stomach have been already passed in review; it may be stated, in addition, that the aggravation of the pain by pressure, when tenderness of the muscles can be excluded, is another most important means of diagnosis. It is rarely absent, unless in cases when the ulcer is situated in the posterior wall of the stomach, and even then it can usually be elicited on deep pressure; and the exceptional cases in which the pain of ulcer has been noticed to be relieved by pressure are scarcely sufficiently numerous to invalidate a diagnosis founded on these data. The tenderness in ulcer also exists in the intervals of the paroxysmal pain. Aggravation of the pain at the menstrual period in females is of less value, as it has been observed both in cases of neuralgic origin and also in ulcer. Exceptional cases may, however, occur in the vomiting from cerebral disease, when epigastric pain, tenderness, and hæmatemesis have all been present, but when no lesion has been found in the stomach after death.[2] They are fortunately, however, of extreme rarity, since the criteria for an accurate diagnosis are in such instances almost entirely absent. The danger, however, consists rather in overlooking the cerebral condition, than of mistaking the nature of the disease of the stomach.

The paroxysmal pain associated with the *passage of gall-stones* may sometimes be a cause of some difficulty in the diagnosis, particularly as it is often associated with tenderness in the right hypochondrium.

The chief points which distinguish this affection are its sudden invasion, its violence while it continues, the persistency of the vomiting, the coexistence of some enlargement of the liver and of an icteric tint of skin, the absence of hæmatemesis, and the immunity from epigastric tenderness, and from dyspeptic disturbances in the intervals.

The diagnosis of the site of the ulcer is sometimes aided by the effects of position in the relief of pain,[1] and in the relative rapidity with which this symptom appears after the ingestion of food, which occurs in some cases earlier when the ulcer is seated near the cardia or in the fundus than when it is situated in the pylorus or duodenum. Pain in the back has been observed to be more severe when the ulcer is on the posterior surface. Excessive tenderness on epigastric pressure has been found associated with those situated on the anterior wall. Absolute accuracy of diagnosis of the site of a duodenal[2] ulcer from one situated in the pylorus, except in cases when the former gives rise to jaundice from obstruction of the common bile duct, appears to be practically almost impossible.

The diagnosis of the event of *perforation* is one of extreme importance in relation to treatment. Unfortunately, the distinction of its early stages from attacks of colic is a question of great difficulty, as is attested by more than one recorded error in diagnosis.

When the event has been preceded by recognizable symptoms of ulcer, its characters can seldom be mistaken; but its sudden invasion, when the disorder has run a latent course, may easily be misapprehended. The chief criteria are the greater severity of the pain, and also of the collapse in cases of perforation, together with the early accession of general tenderness of the abdomen, with vomiting, and with other signs of peritonitis. Severer attacks of colic are often preceded by a history of flatulence and constipation, and by previous slighter forms of the disorder. They are also generally of more gradual invasion than is observed in the pain of perforation. Local spots of tenderness in the course of the intestines can usually also be discovered; and in their neighborhood some variations in the percussion note are generally to be observed. In cases of perforation, on the other hand, the whole abdomen early becomes tym-

[1] Abercrombie, loc. cit. 57. Henoch, iii. 122.

[2] See a case by Empis, De la Granulie, p. 154; when this combination occurred in a case of tubercular meningitis.

[1] In some cases by Osborne, loc. cit., the patient could lie on the affected side when the stomach was empty, but this position caused pain when food had been taken.

[2] It is desirable to recall the rapidity with which food passes from the stomach, as showing that very little reliance can be placed on any distinction of the period at which the pain occurs.

panitic. The difficulty of diagnosis should always induce caution in administering purgatives in cases where any doubt exists regarding the nature of the affection.

It must be recollected that pain after food may remain after cicatrization has been effected. It has been supposed under these circumstances to be due to the irregular contractions of the organ giving rise at times to spasm.

The diagnosis of perforation of the pleural cavity or of the lung must depend on the occurrence of the physical signs of pleurisy, or of the formation of cavities in the pulmonary tissue. That of perforation of the colon has been in some cases disclosed by the passage of undigested food, or by fecal vomiting.

The diagnosis of ulcer from cancer of the stomach will be considered under the head of the latter disorder.

TREATMENT.—The principles to be followed in the treatment of this affection may be briefly summarized under the following heads: (1) Rest. (2) The cure of conditions of the stomach which cause undue acidity from fermentation or hypersecretion. (3) The relief of pain. (4) The relief of vomiting. (5) The arrest of hemorrhage. (6) The relief of constipation. (7) The treatment of perforation.

The measures indicated under the first two divisions are, in great part, regimenal and dietetic. Medicinal remedies also aid these, and are applicable to most of those subsequently named.

(1) It has been seen that many of the most urgent symptoms result from the movements of the stomach in the act of digestion; and our first indication is to reduce these, as far as possible, to a minimum amount, and to maintain the strength of the patient by the smallest quantity of the most digestible food necessary for this purpose, and especially to avoid distension of the stomach by any single large meal.[1]

The same principle should be kept in mind by endeavoring to reduce, as far as possible, all waste of tissue by bodily exertion; and for this purpose complete rest should be enjoined, and the warmth of the body should be fully maintained by external clothing. Confinement to bed during all the severer exacerbations is almost indispensable.

Cruveilhier's method of restricting the patient to a milk diet has been justified by the success which usually attends this plan. The milk should be given in small quantities, rarely exceeding a teacupful, at intervals of two hours; and in severer cases, or when vomiting is frequent, the amount must be restricted to table, dessert, or even teaspoonfuls. Long fasting is highly undesirable, and it is therefore better that the patient should be occasionally wakened in the night than that many hours should elapse without taking nourishment. The milk is often better borne when mixed with well-boiled arrowroot or biscuit powder, since its coagulation into masses in the stomach is thereby prevented. It should not be taken too hot; but there are great differences in individual patients with respect to the temperature at which their food can be taken. Some German authorities recommend buttermilk as a substitute, when milk in its ordinary form appears to disagree; or under these circumstances it may be diluted with water, lime-water, Carrara-water, or soda-water. The last combination is often the most agreeable to the patient. This method may often be continued for many days, or even a fortnight or three weeks, with great benefit; though at the end of this period the patients often acquire a great disrelish and even aversion to the milk diet, and some change may become necessary. [This is especially the case when *skimmed* milk only is given; for which I can find no good ground, either in reason or experience.—H.] It must, however, be borne in mind that occasionally an idiosyncrasy appears to exist against milk, which is not digested, but gives rise to flatulence, acidity, increased pain, and even to vomiting. In the case also of elderly people milk sometimes fails to nourish, and, unless a different diet be adopted, the emaciation and loss of strength of the patient will increase. Under such circumstances recourse must be had to animal broths, made strong, but given cool, and in similarly small quantities at each meal. If pain be severe, or vomiting urgent, I have found great benefit result from the adoption of the method proposed by Dr. Balthazar Forster,[1] of withholding all nutriment by the mouth and administering food entirely by enemata of strong beef-tea, or milk, with which brandy may be combined or not, in doses proportioned to the strength of the patient. Opium may also be given in these enemata, and it not only enables the rectum to retain them

[1] "Verum dum consolidandum est tale ulcus, caveri debet, ne a copiosis ingestis ventriculus distendatur, detraherentur enim denuo illa quæ coire inceperant.—Præcipuum est ut nihil in victu exhibeatur quod exasperare possit hæc mala; jura carnium cum oryza cocta vel mollissimis oleribus hic sunt præcipua; vitelli ovorum, cremores hordei, avenæ ac similia parca copia simul data: ab his enim magnum solamen in doloribus illis chronicis circa ventriculum solent percipi."—Van Swieten's Comm. in Aph. Boerhaave, Ed. 1753, vol. iii. pp. 152, 153.

[1] Lancet, April 25, 1868, vol. i.

longer, but also alleviates the other symptoms. As the state of the patient improves, and the more urgent symptoms subside, more latitude may be permitted; but great caution should be exercised in this respect, even during periods extending over some years. Indigestible food of all kinds must be strictly forbidden, and great care must be continuously exercised to avoid undue distension of the stomach with any single meal, and the more so as the excessive appetite may often tempt the patient unduly to indulge in this respect. Hence, with the precaution that each meal should be small, food should be given at intervals of three or four hours, and milk may with advantage form a considerable proportion of the diet. Lightly-boiled eggs, when these agree, and the more digestible meats, which at first should be well stewed, may be cautiously indulged in. Bread should be eaten stale or toasted; but the use of vegetables should at first be restricted to potatoes in small quantities, and these are often replaced with advantage by macaroni. The importance of a perfect mastication of the farinaceous articles of diet, and indeed of all the food, should be strongly insisted upon. Hot liquids, and especially tea and coffee, should be almost permanently excluded, and should, when possible, be replaced by milk and water, or by cocoa made from the nibs. Malt liquors are generally found to cause flatulence, and to aggravate the pain; Dr. Brinton has, however, observed, that they sometimes agree in the case of elderly people. When stimulants appear to be required, dry sherry or pale brandy, in small quantities, and largely diluted with water, is the best that can be taken.

Sugar, since the objection made to its use by Cruveilhier, has fallen into general disrepute, and it should certainly be only moderately indulged in. It is a powerful stimulant to the mucous membrane of the stomach,[1] and it also easily undergoes acid fermentation—properties which tend to render its use undesirable.

(2, 3) The therapeutic measures under the second and third divisions include most of the remedies ordinarily employed in the treatment of ulcers of the stomach, and it is a question how far their action is directly excited on the disease itself, or in what measure their beneficial agency is due to their influence on the surrounding mucous membrane. The main object in the latter direction is to diminish hyperæmia and its causes, and to check catarrhal action; but as these indications can scarcely be distinguished separately, it will be best to speak of individual remedies which may be employed for these purposes.

[1] See Blondlot, Exp. sur la Digestion, p. 223.

The influence of bismuth in this disorder is too well attested to need any apology for placing it among the first on the list of appropriate remedies. Its beneficial effects in catarrhal conditions of the mucous membrane have been already treated of. Whether or not it exerts any direct influence on the ulcerated surface may be open to question, but such an action would at the least not appear improbable. It appears also to exercise an influence in checking hypersecretion, and for this purpose may be advantageously combined with kino and opium, both of which possess a similar power, or with opium or morphia alone, when this symptom is less marked. It may be administered in the form either of the subnitrate or subcarbonate suspended in mucilage. I have rarely found it necessary to administer a larger quantity than ten grains for a dose, repeated four times in the twenty-four hours; but Dr. Brinton has employed larger quantities, as a scruple.

Opium is the remedy chiefly to be relied on for the relief of the pain and vomiting. The amount given should be sufficient for the more or less complete removal of the pain, and in severe cases several grains of the crude drug may often be given advantageously, in divided doses, in the course of twenty-four hours.

The utility of the salts of silver has been warmly disputed. There can be little probability that the nitrate in the small doses in which it can be administered (which should rarely, if ever, exceed half a grain to a grain) exercises an action on the surface of the ulcer similar to that which follows its application to external parts, since so large a proportion must, from the mucus present in the stomach, be immediately converted into the insoluble chloride. Its agency, however, in catarrhal affections of the stomach, and in cases where, from the pain and vomiting, there may have been great reason to suspect the presence of an ulcer, is so unquestioned, that, though standing second to bismuth as a remedy in this disease, it may be regarded as a valuable adjuvant to our resources in cases when this remedy does not appear to exercise its wonted beneficial effects, and it will sometimes be found to relieve pain after bismuth has failed. [It does the most good in combination with opium; a quarter of a grain of opium with a grain of the nitrate.—H.]

The employment of alkalies, among which may be included the bicarbonates of potash, soda, and magnesia, and lime-water, should be restricted to those cases where, together with flatulency, there is evidence of acidity, resulting from fermentation in the food. The presence of free acid of this nature must exercise an injurious influence, both on the surface of

the ulcer and on the mucous membrane of the stomach, which may be appropriately neutralized by these remedies given between meals. Under other circumstances their use is injurious, as tending, when given on an empty stomach, to excite the secretion of the gastric juice; and except as simple palliatives, they are of no value in the acidity resulting from hypersecretion, which is best controlled by the treatment before mentioned. In cases, however, where they are applicable, the use of the natural or artificial Carlsbad-water has been found advantageous, and it has been highly praised by Ziemssen for its aperient action. Ziemssen considers that, in addition to the neutralization which effects on the acid contents of the stomach, it has the further beneficial action that it tends to promote peristaltic action of the viscus, and thus to prevent undue delay of the food in its interior and consequent fermentative processes.[1]

When the severer symptoms have subsided, if there be evidence of anæmia, the use of iron may be most advantageously resorted to. The neutral preparations—such as the ferrum redactum, the ferri ammon. cit., or potass tartrate, the carbonate of iron, or the mist. ferri co.—are those most suitable; they should at first be given in small doses after food, and their employment is to be discontinued if pain supervene. The recommendation of Abercrombie of the ferri sulph. in combination with aloes has been endorsed by Henoch; but I confess that I regard those above mentioned as safer remedies in these cases.

Pain of a severe kind, indicating the extension of the ulcer, requires additional care in restriction of the diet, and in enforcing absolute rest. It is, as has been already stated, most effectually relieved by opium, to which, for this purpose, hydrocyanic acid is decidedly inferior. The effect of bismuth should also be tried. Warm cataplasms and fomentations also afford relief, and a marked effect of this kind is sometimes produced by the application of a few leeches over the epigastrium, especially if the pain is localized in this region. Their number should, however, be limited to two or three, and it is not necessary or desirable to encourage free bleeding.[2]

Counter-irritation does not seem desirable during the attacks of severe pain, and, in some instances, when an ulcer has appeared to have formed adhesions near the surface, the application of a blister has been followed by increased suffering; but in the intervals and during the course of the disease the use of remedies of this class has been recommended by many careful observers, and when combined with other suitable measures appears to have conduced to a cure.[1] Osborne recommended an issue made with caustic lime, but the least distressing counter-irritants are either mustard poultices, small blisters not exceeding the size of a five-shilling piece, or friction with croton oil.

(4) Pain is also frequently alleviated by the warm bath, and the prolonged use of this remedy has been recommended both by Cruveilhier and by Andral, not only for this purpose, but also as an aid in checking vomiting. The pain of flatulent distension and spasm, though often relieved by opiates, requires occasionally, from its severity, a departure from the general principles of treatment observed in these cases. Emetics cannot be too strongly forbidden,[2] but the use of warm liquids sometimes relieves the spasm and promotes the evacuation of the flatus, or even the regurgitation of the contents of the stomach, in which these attacks commonly end. The aromatic spirit of ammonia may also be used for the same purpose. Nausea and vomiting may be treated, in addition to the remedies before quoted, by ice in small quantities, and by effervescents containing hydrocyanic acid, through the latter are of less efficacy than preparations of opium. This symptom, when obstinate, requires the most extreme restriction of the diet; and it is often advantageous during some hours, or even some days, to avoid introducing any food into the stomach, and to maintain the strength of the patient by nutrient enemata given in as small a bulk as possible. Milk, beef-tea, eggs, and, if necessary, small quantities of brandy, may be given in this manner; and Dr. Brinton, on the advice of Dr. Hawkins, employed cod-liver oil for this purpose with beneficial results. Even opiates may thus be administered with advantage, when rejected if given by the mouth. [Hypodermic injection of morphia will, in some instances, answer still better.—H.] Thirst

[1] Sammlung Clinischer Vorträge (Volkmann), No. xv.

[2] Dr. Brinton opposed the application of leeches altogether; but the benefit that often accrues from their use, by the relief of pain, appears to counterbalance the small loss of blood which they occasion. The cases for their employment require, however, to be judiciously selected.

[1] See the case of Beclard, before quoted.

[2] The danger of these was recognized by Schmidtmann, Summa Observationum Prax. Med. iii. 224, 395, who, in addition to cases within his own experience, where they were followed by a fatal issue, quotes a case from Boerhaave, that of Admiral Wassenaer (Op. Omnia, 1738, p. 98), who died of rupture of the œsophagus from this cause.

may be quenched by slowly sucking small pieces of ice.

Vomiting appears in some cases to be maintained by a loaded condition of the bowel, and in these the administration of a purgative enema is sometimes beneficial.

(5) Hemorrhage must be controlled by cold and by direct astringents. I have found none so dependable as the acetate of lead given in doses of three or four grains, in combination with a quarter of a grain of opium, every two or three hours. Turpentine has been recommended by Hunter, and its utility has been confirmed by Drs. Graves and Seymour. Dr. Budd thinks it more useful in cases of capillary hemorrhage than when the blood proceeds from larger vessels. The use of other remedies of this class will be further alluded to. (See Hemorrhage.) [Creasote, a drop or two at a dose, may be given in this affection with more confidence than most styptics.—H.]

Ice internally may be employed with advantage for the same purpose, and this agent and also opiates are useful in checking the movements of the stomach in the effort of vomiting, by which the tendency to bleeding is necessarily aggravated. During the continuance of this symptom the most absolute rest of body must be enjoined. The diet should be restricted, in the same manner as when vomiting is present. When severe collapse is threatened, stimulant enemata may be given, and ether inhaled. It is important also to watch the fecal evacuations after the hæmatemesis has ceased.

(6) Constipation is always to be treated with caution; an almost universal consent has proscribed mercurial preparations as injurious. When it does not nauseate or cause vomiting, there is no better laxative than castor oil: but in the numerous instances in which its use is prevented by the intolerance of the patient, the best substitutes are aloetics and the pil. colocynthidis composita. The administration of purgatives by the mouth should, however, as far as possible, be avoided, and the action of the bowels assisted by cold or tepid enemata, in which manner also castor oil may often be beneficially employed.

(7) When perforation is threatening or has occurred, the most absolute repose to the patient and also for the stomach is an object of primary importance. In the former case Miquel has recommended that such a position should be maintained as to leave the ulcer free from contact with the contents of the stomach. When the event has taken place, no agent appears to have any curative influence but opium, and its use must be continued for many days; the nutrition must be also conducted entirely by enemata. The only favorable recorded terminations to this event are those where these plans were pursued. If life should fortunately be prolonged, the importance of a long-restricted diet, so as to avoid the distension of the stomach, cannot be too strongly insisted upon. Finally, patients should be warned that in intervals of comparative immunity from urgent symptoms they are still in danger of relapses; and a case by Cruveilhier,[1] in which a return of the ulceration after many years of immunity followed the free exhibition of purgatives for a cerebral affection, may well awaken the question put by that distinguished author, whether these remedies were not truly the cause of the relapse, and should induce caution in all treatment, hygienic and medicinal, of patients in whom the disorder has once existed. The later effects arising from constriction of the pyloric orifice may be obviated by the use of a diet chiefly solid in order to avoid distension by flatulence, or, when this has occurred, by the employment of the stomach-pump after Kussmaul's method.[2]

VII.—Cancer of the Stomach.

Definition.—A disease of uncertain duration, characterized by the symptoms of pain, vomiting, perversions of the secretions of the stomach, and disturbances of the appetite and digestion, and tending to a fatal termination by marasmus, cachexia, or hemorrhage; whose essential anatomical character depends on the development in the coats of the organ of a heterologous growth presenting the structural peculiarities and pathological course of cancer.

History. — Tumors forming in the coats of the stomach, and tending to ulcerate, have been known from very early times. Their nature, however, has only become more strictly defined by the extension of the knowledge of pathological anatomy, which has revealed the dependence of many cases formerly described as melæna and cardialgia upon growths of this nature.[3]

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[1] Path. Anat., Liv. xx. p. 2.

[2] See Ziemssen, loc. cit.

[3] The most complete accounts of the pathological anatomy of this disease are to be found in Carswell, Illustrations of the Elementary Forms of Disease; Rokitanski, Path. Anat.; and Cruveilhier, Path. Anat. (excellent illustrations of the colloid form). Their clinical history, etiology, and pathological anatomy have also more lately been described by Walshe, On Cancer; Lebert, Traité des Malad. Cancereuses; Brinton, Med.-Chir. Rev. 1857, and Diseases of the Stomach; Dittrich, Prag. Viertel-Jahresch. vol. xvii. For other

ETIOLOGY. — *Frequency.* — The estimates of the comparative frequency of this disease in relation to all other causes of death vary between 0·6 and 2½ per cent.[1] It appears, therefore, that the disease is less common than the simple ulcer of the stomach, but its extreme fatality places it on about the same level in respect to its frequency as a cause of death.

Regarded in relation to primary cancers in general, that of the stomach is one of the most common occurrence. Tanchou's tables represent it as forming 25·2 per cent., Marc d'Espine's 45 per cent., and Virchow's 34·9 per cent. of the whole number of cancers recorded, equalling, if not exceeding, in frequency those of the uterus and mamma.

Age.—Dr. Brinton's returns from 600 cases show that three-fourths of these occur between 40 and 70; and that the greatest number is met with between 50 and 60; though, allowing for the number of all persons living, the maximum liability is found between 60 and 70—a result very closely corresponding for the particular organ with that deduced by Dr. Walshe for the whole class of these diseases.[1] It is decidedly a rare event in the earlier periods of life, but a case of congenital scirrhus of the stomach is recorded by Wilkinson;[2] though ordinarily, when occurring in this organ during childhood, it tends to assume the medullary form.

Sex.—The data on this head are somewhat uncertain. Brinton, from 784 cases, considered that there was an excess in the male sex in the frequency of its appearance. As other writers have, however, given very different proportions,[3] the sexual influence cannot be considered very strong in determining or preventing the localization of the disease in the stomach; nor does the united influence of age and sex present at all the same remarkable etiological features as are observed in the case of gastric ulcer.

The remaining causes of the disease in this special seat are as obscure as those which determine its appearance in other parts.

Hereditary transmission appears to operate with the same uncertainty as prevails with regard to the whole class of Tumors. Its influence as an occasional predisposing cause can scarcely be questioned, and the case of the Napoleon family, so often cited, is a striking illustration of this tendency.

The influence of direct irritation[4] or inflammatory action maintained by Boerhaave and Van Swieten,[5] and also by

illustrations and cases see Abercrombie, loc. cit.; Réné, Prus. Rech. Nouvelles sur la Nature et le Traitement du Cancer de l'Estomac; Barras, Préc. Anat. sur le Cancer de l'Estomac; Müller, Krankhaften Geschwülste; Bruch, Henle and Pfeuffer's Zeitsch. 1849; Bennett, Cancerous and Canceroid Growths and Clinical Medicine; Köhler, Krebs, und Scheinkrebs, 1853; Broca, Mem. Acad. de Méd. 1852. See also articles in Dict. des Sciences Méd. and Dict. de Méd. by Bayle, and Fayol, and Ferus; Chardel, Dég. Squirrheuses de l'Estomac, 1804; Valleix, Guide du Méd. Pract.; Handfield Jones, Budd, and Habershon, before quoted. For other references see Walshe and Lebert, and articles in Cyc. Pract. Med. and Copland's Dictionary.

[1] The smallest number is given by Tanchou (Rech. sur le Traitement Médical des Tumors du Sein, Paris, 1844), founded on an aggregate of 382,851 deaths in Paris, during the years 1820–40. Virchow (Phys.-Med. Gessell., Würzburg, vol. x. and Krankhaften Geschwülste, vol. i.) and Brinton (loc. cit.) agree in their estimates of about 1 per cent.: that of the former author being based on a total of 3396 deaths in the mortality returns of Würzburg during the years 1852–5; that of the latter on a collection of records of 8468 post-mortem examinations in various London hospitals. An almost similar correspondence in an average of 2 to 2½ per cent. is attained by Marc d'Espine (Statistique mortuaire du Canton de Genève pendant les années 1838–1855, Echo Médicale, 1858, quoted by Lebert and Virchow) and by Willigk (Prager Viertel-Jahresch. Nos. 38, 44, 50, 51); that of the former being derived from the registers of the Canton of Geneva, while that of the latter is founded on the recorded necropsies, amounting to 6196 cases, in the hospitals at Prague. Willigk's percentage of the relative frequency of cancer of the stomach to other cancers agrees very closely with Virchow's.

[1] Loc. cit. pp. 149, 151.

[2] Edin. Med Journ. Jan. 1841, quoted by Dr. Walshe, p. 146.

[3]

		Cases.	Males.	Females.
Brinton	gives	784	440	344
Louis	"	33	20	13
Lebert	"	42	19	23
Marc d'Espine	"	116	54	62
Dittrich	"	159	64	95
Willigk	"	169	83	86

In Dittrich's and Willigk's cases there was an excess in the number of females dying in the hospital. Brinton considered that the excess in the male sex was due to the greater proclivity of the generative organs in the female to become the seat of cancer.

[4] Among the curiosities of this class may be mentioned where corrosive poisons have been followed by an outbreak of cancer: as after nitric acid, recorded by Andral, Clin. Méd. ii. 99; or arsenic, Dittrich, Prag. Viertel-Jahreschrift, xix. pp. 110, 114. The latter case may, however, be well contrasted with one quoted by Dr. Walshe, when a mass of arsenic was encapsuled in the stomach, without further apparent injury. (Cancer, p. 167.)

[5] Comm. in Aph. Boerhaave, 1758, vol. iii. pp. 147, 150.

Broussais and Andral,[1] and by other writers of the French school, can only have a direct influence attributable to them under circumstances of some[2] as yet unknown constitutional predisposition. A direct effect also can scarcely be attributed to habits of spirit-drinking, or to blows, or other mechanical injuries or pressure on the epigastric region; nor even to depressing emotions when independent of the unknown antecedent conditions, though this class of causes has frequently been observed to favor either the immediate outbreak or the more active development of the growth.

What the local predisposition may be that causes the stomach with such great proportionate frequency to become the seat of this disease can only be in great measure a matter for conjecture. Virchow's argument that the organs and parts of organs which most frequently suffer from morbid growths are either those which, from their position or structure, are most exposed to or susceptible of injurious influences from external agencies, or are those whose nutritive processes[3] are conducted under special and peculiar conditions, finds at least a basis in the case of cancer of the stomach: but it is also deserving of notice, as pointed out by Dr. Brinton in relation to this question, that the disease only very rarely commences on the surface of the mucous membrane.

Marc d'Espine's returns show an excess of mortality from cancer of the stomach in the wealthier classes. Of twenty-one cases there were fifteen rich to six poor,[4] but these numbers appear too small to serve as the foundation of a comprehensive induction.

Bamberger states that it is most common in flabby and fat persons, but gives no further detail.

Symptoms.—Cases of cancer of the stomach may be divided into two distinct groups,—one in which the disease, even when attended by extensive ulceration, may run an almost latent course, and even arrive at a fatal termination, unmarked by any severer symptoms than annorexia and dyspeptic disturbances of a comparatively insignificant character, but attended by a gradually increasing emaciation and loss of strength—and a second, when its presence excites the more formidable disturbances of pain, vomiting, and hemorrhage. A third variety, however, occasionally occurs, in which cases that have presented the features of the first-named class may towards the close assume the more distressing characters of the second. A fourth also is sometimes met with, where the pain or vomiting, which have been the first symptoms, has ceased, and the disease has advanced to a fatal termination, and where the only distinct symptom has been a steady progressing emaciation (Abercrombie).

Cases of the first kind, though by no means rare in the history of medicine, do not form a large proportion of the whole.[1] The absence of the more prominent symptoms may often be traced to conditions affecting either the site of the growth, the rate of its enlargement, or the depth and extent to which ulceration has proceeded, or the relation of the nerves or vessels of the stomach to the tumor.

In its ordinary course the disease is usually first manifested by symptoms of dyspepsia, beginning without apparent cause in a person who has arrived at middle age, and who often has previously enjoyed good health. These may be at first very undefined, consisting of weight and uneasiness felt at the epigastrium after taking food, and followed by gaseous, acid, or insipid eructations. The tongue in the mean time is usually found unaffected, pale, or presenting its normal appearance. Thirst is generally absent. Loss of appetite is often an early and

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[1] Clin. Méd. ii. 31, 60, 61.

[2] Symptoms of chronic inflammatory action or dyspeptic disturbance have indeed been noticed to precede for many years the severer symptoms; but it is doubtful whether, on the one hand, these may have not been caused by a latent growth of the disease, and, on the other, how far, considering the prevalence of these symptoms in patients who do not become cancerous, any influence in the production of the disorder can be ascribed to such derangements. Beau, Gaz. des Hôpitaux, 1859, pp. 390–1, says that an "idiopathic" dyspepsia may long precede cancer of the stomach. Lebert's analysis, however, would show that in the majority of cases of cancer of the stomach the digestion has been accomplished naturally up to the period of the appearance of the disease.

[3] Dr. Walshe's critical remarks on this question deserve the most attentive consideration, from the remarkable logical acumen with which he has handled it, loc. cit. pp. 94, 95.

[4] Ann. d'Hygiène, 1847, xxxvii. p. 323, quoted by Lebert.

[1] For observations of this nature see Pemberton, Dis. of Abdominal Viscera, p. 84; Sir T. Watson, Princ. and Pract. Physic, vol. ii.; Seymour, Med.-Chir. Trans. vol. xiv.; Andral, Clin. Méd. ii. Cruveilhier also gives a case where the appetite and digestion were preserved, and the only symptoms were dropsy, emaciation, and pyrexia: Path. Anat., Liv. x. A very similar one is recorded by Abercrombie. Even extensive ulceration appears in some cases to have been attended by little or no vomiting, and by only comparatively slight disturbance of the digestion.

prominent feature. The strength fails, and signs of emaciation, at first slight, become increasingly distinct. As the disease advances the epigastric uneasiness passes into pain, which is often of considerable severity. Vomiting also takes place at irregular intervals. Rare at first, and attended only with the rejection of food, or of mucus, which may be stained or mottled with streaks, specks, or flakes of rusty, sooty, or coffee-ground tint, it occurs more frequently as the disorder progresses. Flatulence and constipation become at this period prominent symptoms, and the patient is often dejected, morose, irritable, or desponding. At variable periods in the history of the case a tumor becomes perceptible in the epigastric region. In proportion as the disease is more fully declared, the epigastric pain grows severe and distressing. Vomiting is frequent, and large quantities of more or less altered blood are at times ejected. The emaciation deepens into cachexia; the skin acquires an earthy tint; diarrhœa alternates with constipation; febrile action, akin to hectic, sometimes appears towards the close, though usually this symptom is absent; dropsy, general or local, occasionally supervenes; and the patient dies exhausted after one or two years of suffering, and an extreme degree of marasmus.

The symptoms, however, often differ considerably in their relative intensity, and also in the order of their occurrence, and appear to merit some separate consideration.

The duration of the preliminary stage is very variable, and the disturbances in the digestion may present nothing characteristic, and may even be entirely absent up to the fatal termination (Cruveilhier).

Anorexia, however, though by no means constant (as the appetite is in some cases maintained to the close of life), is a very distinctive feature of the disorder. Generally it proceeds *pari passu* with the pain and with the increasing cachexia and debility, to which, in many cases, it stands in direct relationship. Sometimes, however, it occurs early in the disease, and appears to be quite unconnected with the latter symptom, and under these circumstances it is, according to Brinton,[1] more marked in proportion to the youth of the patient and to the softness of the cancerous growth. There are, however, intermissions sometimes of considerable duration, in this disrelish for food, and, instead of being lost, the appetite may be capricious or fanciful. According to Lebert's and Brinton's estimates, anorexia occurs sooner or later in from 78 to 85 per cent. of all cases of cancer of the stomach, and thus forms a remarkable contrast with the condition of the appetite in cases of gastric ulcer. When, however, vomiting is present, and especially when this arises from obstruction of the pylorus, the appetite may be found to be increased.

Pain is the most constant,[1] as well as the most marked, symptom. It is frequently the first in its appearance, and is often during a long period the only evidence of the disease. At first it seldom presents the same intensity as in the latter stages of the disorder, and it may then only exist as a dull aching felt in the epigastric region, or in the back.[2] It is, however, often of intense severity, and is described as burning, tearing, or lancinating;[3] but this latter character is not always observed. There are, not unfrequently, complete intermissions in its appearance, which may last over many days, or even weeks; in other instances, even when the pain is of great severity, it may be nearly continuous. In some cases it may occur in paroxysms of considerable severity, resembling attacks of cardialgia, or even colic, obliging the patient to double himself up for many hours, and it may occur in this manner, unattended by other symptoms, for years.[4] These attacks are not, however, so frequent in cancer as in ulcer of the stomach, and the character and intensity of the pain are influenced by the occurrence of ulceration, by the invasion of large branches of nerves,[5] by the position of the ulcerated tumor, and by the extent of surface affected.

In site it may either be localized, or it may extend through the whole epigastric region. It is often felt in the back behind the scapulæ and in the course of the spine.[6]

[1] This author records a case where the anorexia was only manifested by a sudden disrelish for tobacco in an habitual smoker, but which, combined with a cachectic appearance, induced both the patient's attendant and himself to diagnose the existence of cancer, which was shortly after verified.

[1] Lebert says that it occurs in five-sixths, and Brinton in 92 per cent. of the cases which they have collected.

[2] As in a case by Sir T. Watson, where the patient was obscurely seated in the lumbar region, giving rise to the suspicion of renal calculus, but also resembling lumbago.

[3] Authorities are divided in their statements regarding this character of the pain. Bamberger, Lebert, and Brinton speak of it as being frequent; Walshe, Andral, Henoch, though affirming its occasional occurrence, deny its comparative frequency.

[4] The case of the first Napoleon is an instance of this. One presenting very similar characters has come under my own observation.

[5] As in a case by Sir T. Watson.

[6] Brinton says that he has observed scapular pain in cases of cancer of the cardia, and pain in the lower dorsal and lumbar region,

It is sometimes, especially when a tumor can be felt, associated with distinct tenderness on pressure over the site of the growth, which is more marked in proportion to the superficial character of the latter, though this symptom is not unfrequently absent.

The pain is commonly, at least in the later stages, aggravated by the ingestion of food; but in the earlier periods of the disease this relation is not so distinctly observed as in cases of ulceration, nor is the pain so commonly relieved by vomiting.

Vomiting, though less constant, and usually appearing later than pain, is, however, a symptom of great frequency, being recorded, according to Brinton, in 87½ per cent. of all cases.

It is most frequent when there is ulceration of the surface, or obstruction of the orifices by the tumor; but that it does not depend exclusively on either of these conditions is shown by its absence in some cases where they have both been found, and by its presence in others in early stages of this disease, and when neither exist.[1] Its appearance under the latter circumstances is probably due to the direct irritation of the excito-motor nerves of the organ by the progress of the growth, and to the same influence must be attributed its occurrence in those cases when it has been excited by pressure on the tumor (Lebert).

The period at which it follows eating is generally influenced by the position of the cancer. When the cardia is obstructed, the food is usually rejected immediately after deglutition, unless the return is delayed by dilatation of the œsophagus. When the pylorus is the seat of the disease, food may be retained for some time before it is returned.[2]

Occasionally, however, vomiting occurs when the stomach is empty, and this is sometimes observed in the morning, when mucus is usually brought up—a symptom possibly referable to coexistent gastric catarrh.

Its frequency usually increases with the progress of the disease, but long intermissions between the attacks are common in all stages. The intervals also tend to become longer when dilatation of the stomach has ensued in consequence of obstruction of she pylorus; but when vomiting occurs under these circumstances, enormous quantities of acid and fermenting food are rejected from the stomach.

In some cases vomiting, which has been frequent in the earlier stages, may almost entirely cease towards its close—a change which has been occasionally traced to the pyloric orifice again becoming opened by ulceration.

The matters vomited vary. Mucus has already been alluded to, and the ejection of an acid fluid apparently derived from hypersecretion is not very uncommon.[1] When there is an obstruction at the cardia, the food is returned but little altered, and merely macerated and covered with a layer of mucus. When the pylorus is obstructed, food undergoes the changes before noticed, and sarcinæ and torulæ are often found in the yeasty scum which forms on the surface. In fact, though sarcinæ occur in the matters vomited in a great number of stomach affections, their presence is more frequently observed in cases of cancer of the pylorus than in any other single disease to which the organ is liable. Cancer cells, also, are said to have been met with in the ejected matters, but the cases in which their distinctive features can be recognized must be extremely rare.[2] When sloughing action is taking place in the cancer, the vomited matters and the eructations may be offensive, but this is in some measure prevented by the antiseptic action of the gastric juice.

Hiccough sometimes forms a very distressing symptom, which, however, usually only appears with any severity towards the close of these cases.[3]

Hemorrhage to a greater or less degree occurs, according to the statements of Lebert and Brinton, in nearly one-half of the recorded cases of this disease. It may be divided into two classes: slight, when only small amounts of rusty, sooty, or chocolate-tinted specks appear in the

when the growth has been found on the posterior surface of the stomach.

[1] Lebert. See also a case by Dittrich, loc. cit. p. 114, where there was almost complete scirrhous degeneration of the coats of the whole organ, and yet vomiting was absent. I have met with a similar case.

[2] The act of vomiting does not appear to be determined by the position of the tumor, independently of the obstructions to which it may give rise. See Lebert, p. 505.

[1] Golding Bird states that in a case of scirrhus of the pylorus, where the patient vomited several pints of fluid in the twenty-four hours, he found a "quantity of free hydrochloric acid, equal in each pint to 22 grammes of pharmaceutical acid, in addition to a considerable quantity of some organic acid (lactic?), sufficient to neutralize nearly 7 grains of pure potash; at another time the hydrochloric acid nearly disappeared, and the quantities of organic acid in each pint required for saturation nearly 17 grains of the alkali." (Urinary Deposits, 1857, p. 162.)

[2] See *ante*.

[3] Bamberger has observed that it is not caused by implication of the diaphragm, but is more often connected with extension of the growth to the peritoneal surface of the stomach.

matters vomited; and larger losses of blood, in which pints may be ejected.

The former class is more frequent in cancer than in ulcer, since in addition to the congested condition of the mucous membrane surrounding the tumor, in which varicose veins have sometimes been observed (Andral), the capillary vessels on the surface of the tumors are liable to bleed, a tendency especially noticed in fungating excrescences.[1]

This form usually appears in the early stages of the disorder, while the larger hemorrhages are usually associated with rapid sloughing destructive processes, and, in contrast to the other variety, they are less frequent in cancerous than in simple ulcerative disease. The symptoms of the larger hemorrhages are similar to those observed during the progress of simple ulcer; and in these also the blood may escape by stool, and may give rise to melæna and diarrhœa.

The discovery of a tumor forms one of the most important elements in the recognition of the nature of the disease. From the returns of Brinton and Lebert, it may be felt in from 70 to 80 per cent. of all cases observed, and, even when not distinctly perceptible, there is often an induration associated with dulness of percussion note over some portion of the regions occupied by the stomach. The position of the tumor necessarily influences the facility with which it is detected by physical examination, and those in the cardia or in the posterior wall may occasionally elude observation.

The period at which it is felt is usually when other symptoms have existed for some time; but this, again, depends in great measure on the position in which it is developed. Its site is usually at the epigastric region, or (from the comparative frequency with which the pylorus is affected) in the right hypochondrium. Brinton states, that in the female sex it may be found in the umbilical region in nearly two-thirds of all cases in which it is discoverable—a peculiarity due, in a great measure, to the effects of the compression of the lower part of the thorax by stays. Similar displacements, common to both sexes, may be due to the weight of the tumor dragging down the pyloric end of the stomach, when this is not retained by adhesions in its original site. The tumor feels hard and irregular to the hand, especially when it is large and situated near the anterior surface; it is generally immovable by manipulation, but alters its position through distension of the stomach by food, or by gradually increasing dilatation of the viscus. Sometimes it may disappear entirely for many days, either from the twisting of the stomach upon its axis, by which the pylorus is brought below the liver, or from its being covered by a distended colon. In some cases, Brinton thinks that its complete disappearance may be due to sloughing and destruction of the growth. Pulsation in the tumor is not uncommonly observed, due probably, in most cases, to an impulse derived from the abdominal aorta. Instead of a circumscribed mass, the whole epigastric region may be hard, prominent, and resisting, and, in some cases, the form of portions of the stomach may become prominent through the abdominal wall[1]—a condition which usually depends on extensive infiltration of the coats of the stomach by the cancerous growth. In these cases the percussion note, instead of being absolutely dull, may have a muffled tympanitic resonance; a peculiar tinkling sound has also sometimes been heard when liquids are swallowed, arising from the fall of the fluid into the dense cavity (Bamberger).

The signs of contraction or distension in the stomach consequent upon pyloric or cardiac stenosis will be given under the head of these affections.

The tongue presents but few characteristic features. Its appearance is not necessarily affected by the cancer, and the varieties of fur, aphthæ, &c., occasionally observed, depend more on the general condition of the patient, and especially on the coexistence or absence of a catarrhal condition of the mucous membrane. An excessive salivation with characters similar to these observed in ulcer has been sometimes noticed.

The cachexia in cancer of the stomach very frequently presents the most characteristic features of this disease. It sometimes appears early in the disorder, though its progress is usually proportioned to the severity of the vomiting, hemorrhage, pain, and disturbances of digestion. In the early stages, however, and even sometimes at an advanced period, there may be very little external evidence of disturbance of health.

When the cachexia becomes marked, the face is pale and sunken, with deepening of the naso-labial wrinkles. The expression is anxious and careworn, or indicative of pain. The skin acquires an opaque earthy tint, which is equally marked in fair as in dark-complexioned people; in other cases, and particularly when hemorrhage has occurred, it has the waxy look of exreme anæmia. It is

[1] Hence these rusty coffee-ground vomitings, though common to both disorders, were regarded before the time of Cruveilhier (who showed that they also took place in ulcer) as peculiarly characteristic of cancer of the stomach.

[1] Louis, Mem. Anat. Path. 130, quoted by Dr. Walshe.

often dry and rough from the desquamation of the cuticle and from the want of perspiration. Jaundice or a straw-colored icteroid tint of skin is not uncommon. The lighter shades of jaundice are rather more frequent; the severer cases depend on pressure by the growth in the stomach on the common bile duct, or on secondary formations in the liver.

Œdema often appears towards the close of the complaint, arising either from the general hydræmia, or limited to one of the lower extremities, through venous obstruction from thrombosis. Ascites is also occasionally, but not constantly, observed; its occurrence depends either on the pressure exercised by the tumor on the portal vein, or on cancerous formations in the peritoneum, of which latter cause the most frequent examples are afforded, in proportion to their number, by the extensions of the colloid variety. Obstructions of the arterial circulation, either by thrombosis or embolism, are also occasionally observed; they then give rise to intense pain in the limb affected, with burning or cramp-like sensations, and sometimes to great temporary hyperæsthesia of the skin, which, at a later period, are followed by gangrene of the part below the seat of obstruction.

Febrile reaction is the exception rather than the rule, but it is sometimes very distinctly marked, and especially towards the close of the complaint.[1] Its occurrence is frequently due to some secondary inflammatory action, among which pneumonia, associated either with cancerous deposits in the lung, or of the hypostatic variety, is one of the most frequent causes.

Emaciation and loss of strength usually progress rapidly from the first outset of the severer symptoms, though occasionally the nutrition and general vigor are maintained for a year or eighteen months (Lebert). In many cases, however, these symptoms are among the most prominent present; and there are few in which, towards the close, marasmus does not form a very marked feature; while in others, even at the commencement, and while the other symptoms are still obscure, the presence of these signs may, as has been before noticed, form valuable indications of the nature of the disease.

The Duration of the disease, regarded from the origin of the cancerous growth, is very indefinite; in fact, it appears impossible in all cases to fix the period of its commencement. The length of time during which some patients have suffered from even severe pain (as in the case of Napoleon, in whom this symptom occurred at intervals for nine years before his death—Abercrombie) points to the probability that the disease may occasionally persist long, without much disturbance of the general health, or of the functions of the stomach. Ordinarily this period of comparative latency rarely extends beyond two or three months, though it has been known to last for a year and a half (Lebert).

The average duration is estimated by Dr. Brinton, from 198 cases, as amounting to 12½ months, which corresponds pretty closely with the results obtained from smaller numbers by Lebert and Valleix. The minimum course which I can find recorded is one of four months (Valleix). The longest period which has been known to elapse from the first distinctive symptom to a fatal termination has been three years and a half.

Prognosis.—The termination has been invariably fatal: only very untrustworthy evidence has been afforded of the cure of the growth by enucleation and cicatrization; and evidences derived from cicatrices are uncertain, as we can never exclude the possibility of their having resulted from chronic ulcer (which has been shown to be a more common disease than cancer); nor can the same probability in favor of their origin from simple ulcers be denied in those instances where a cancer and cicatrices have been found coexistent in the same stomach.

Cancer, it is known, possesses the destructive peculiarity, that it is never circumscribed, but that the tissue around its margin is constantly found presenting more or less evident perversions of development with structures analogous to those of the morbid growth. In the presence, therefore, of the direct clinical experience which the course of the disease constantly affords us, and owing to the fallacious resemblance between its symptoms and those of ulcer, the evidence of the possibility of its cure must be established by more direct proof than has hitherto been furnished, or than the circumstances attending its formation in this position appear capable of affording, before this can be admitted, even on hypothetical grounds, to alleviate in any way the gloomy prognosis to which its recognition must always give rise.

The probability of a rapid course is determined by the severity of the vomiting and hemorrhage. Lebert considers early vomiting an unfavorable symptom. Cases exhibiting it have frequently terminated fatally in from four to six months.

Pathology.—The pathology of the disease will only be treated of in this

[1] I have, however, known febrile action, due apparently to an abscess formed behind the stomach, persist during nearly two months.

place in relation to special anatomical peculiarities affecting the organ.

The growth occurs in all the known forms assumed by cancer in the order of frequency here enumerated: scirrhus; medullary (and combinations of these); colloid, either simple or combined with either of the above; villous; and melanoid. Of these scirrhus is found in nearly three-fourths of the whole number,[1] but it is seldom unattended by softer portions on the surface or margins, which approximate in their structure and character to the medullary type.

The seat of the cancer is, in the majority of cases, in the pyloric region.[2] The cardia, from Brinton's and Lebert's returns, only appears to suffer in about 10 per cent. of all cases. Extensions beyond the pylorus to the duodenum are extremely rare;[3] but when the pylorus is affected, the cancer usually extends around the whole circumference of the valve, and thence invades the smaller curvature. When the cardia is affected, the growth is generally, but not constantly, found to extend into the lower part of the œsophagus. The proportion of all cases in which the orifices taken collectively are affected amounts to 71 per cent.; an excess in these parts which, as Brinton has pointed out, is considerably greater than that observed in cases of simple ulcers.

Cases where large tracts of the stomach are invaded are usually those where the cancer is of the colloid variety, but it is occasionally noticed in other forms.[4]

The growth, when of the scirrhous or medullary forms, almost invariably takes its origin in the submucous tissue. It has been found, however, by Dittrich,[5] commencing in the subserous cellular tissue.[6] The development of the colloid form will be more particularly alluded to hereafter.

The special forms are each connected with some anatomical peculiarities, which require a separate description.

Schirrus of the stomach presents the same contracting, indurating characters that distinguish the growth in other parts. Commencing, as just stated, in the submucous tissue, it thence extends in about equal degrees into the mucous membrane, and also into the muscular coats. The invasion of the mucous membrane is frequently marked by striated radiating lines of a cicatricial appearance, attended with destruction and atrophy of the glandular textures and induration of this coat, and sometimes by retractions and depressions of portions of the, as yet, unbroken surface. The true mucous structure (viz., the glands and villi), however, often resists during the long period the cancerous encroachment, although the membrane early becomes fixed and immovable upon the submucous tissue.

Through the character of the growth, in which, as elsewhere, the fibrous stroma greatly predominates over the cellular elements, the parts affected by it become converted into a firm, unyielding mass, in which all their distinctive features are lost. When large tracts are thus affected, the disease may at first sight present a great resemblance to fibrous thickening, or to hypertrophy of the coats of the organ.[1]

The invasion of the muscular tissue by the growth takes place, as pointed out by Rokitanski, in the intermuscular septa, which form meshes inclosing spaces containing unaffected muscular fibre. The portions thus included present a reddish or a semi-transparent appearance, and their histological elements are at first greatly enlarged, but subsequently degenerate into the cancer structures.

The effect of these changes is to produce great contraction of the parts in which they occur. Either at the pylorus or cardia the immediate result is an extreme narrowing of their openings, which is often heightened by irregular masses protruding at the surface, and by polypoid vegetations, which, though less common

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[1] Brinton, from 180 cases.

[2] Of 360 cases Brinton found that this was affected in 60 per cent.; Lebert, 34 times in 57 cases.

[3] Cases in which this has occurred have been recorded both by Lebert and by Brinton.

[4] Brinton in 360 cases has found 13 in which the whole stomach was found thus degenerated.

[5] Prager Viertel-Jahresch. xvii. p. 6.

[6] In some of these cases this author has observed a scirrhous degeneration of this layer, together with a medullary growth in the submucous tissue, the intervening muscular coat having been unaffected.

[1] The diagnosis between these two alterations is not always an easy one, since, as in other parts affected by scirrhus, large tracts of tissue may often be found presenting nothing but a dense fibrous structure, and devoid of the cell-structures which are usually found in the more open meshes of the stroma, though these, as pointed out by Rokitanski, can usually be found at the margins of the growth. In addition to the cancerous character of the margin, the scirrhous growth is also distinguished by its affecting all coats equally, by their fusion into a uniform mass of pearly whiteness, and presenting the gristly cartilaginous texture characteristic of this form, by the immovability, except at the earliest stages, of the mucous membrane upon the tissues beneath, and by the destruction of the normal appearances of the muscular layer. Two cases exhibiting the contrast of these forms are recorded by Dr. Wilks, Path. Soc. Trans. x. 136, xiii. 83.

than in the medullary variety, sometimes accompany scirrhous cancer.

When large tracts of the coats are thus invaded, the stomach may be externally shrunken and contracted, so as to resemble a fowl's gizzard in appearance,[1] with dense inflexible walls, which may even attain the thickness of an inch. The small curvature may be so shortened as to bring the pylorus and cardia into close proximity, and the inner surfaces of the interior and posterior walls may be almost completely in contact.[2]

Medullary cancer, commencing in the same tissues as the scirrhous variety, appears usually in the forms of nodules, in masses of varying degrees of softness, and of a cerebriform appearance; more rarely it occurs as an infiltration of the different coats.

Though the peritoneum suffers with less frequency, the mucous membrane is invaded with greater rapidity by medullary than by scirrhous cancer. The nodules, when seen on the external surface, present, with exception of their softness and cerebriform appearance, very few peculiarities. In some cases the growth on the mucous membrane tends to form large fungating excrescences, in which an exaggeration of the villous type is observable. These constitute the varieties of the so-called villous cancer, which may sometimes form large tumors, thickly covered with the hypertrophied villi.[3]

The melanoid form is very rarely observed.[4] In some cases it appears as small scattered nodules in or under the mucous membrane, which present the ordinary characters of medullary cancer, with the exception that the cell structures are loaded with melanic pigment.

The colloid or gum cancer has its most frequent seat in the stomach, but even here it is not of comparatively frequent occurrence.[5] Its site of origin appears to be rather more doubtful than is the case with the other growths before alluded to. Some authors state that it begins in the submucous tissue, others in the subserous.[1] My own opinion, which I would however state with some hesitation, is that this variety of "cancer" is essentially of glandular origin, and akin to those forms of epithelioma of the skin described by Remak,[2] which commence with heterologous extension of the sebaceous and sudoriparous glands into the deeper structures.[3]

It is possible, that when apparently commencing in the deeper coats, this growth may, under such circumstances, take origin in the little glandular masses which occasionally are found in these parts, and having no connection with the rest of the mucous membrane, and of which I have seen some examples.[4] How-

[1] As in a specimen cited by Dr. Walshe.

[2] Dittrich. In one such case the mucous membrane was found smooth and shining, as if from the effects of attrition; but later it may become the seat of ulcerations hereafter to be described.

[3] Their structure can be very well seen when examined under water. Each villus contains a loop of vessels, and the larger ones are usually filled with cancer cells. The delicacy of the structure of the capillary walls, which are often only covered by a single layer of epithelium, and the softness of the whole growth, together with its extreme vascularity, render this variety a dangerous source of hemorrhage.

[4] Only three times in 180 cases, Brinton; once in 160 cases, Dittrich. In Dittrich's case it was coincident with a general dissemination of melanoid tumors throughout the body.

[5] In 180 cases of Dr. Brinton's, colloid was found 17 times. In 160 of Dittrich's it only occurred in 11 specimens, and in three only of these was it uncombined with either scirrhous or medullary growths.

[1] Brinton, loc. cit. 239.

[2] Deutsche Klinik, 1854, p. 70 et seq.

[3] I must state that, since my attention has been devoted to this question I have only had an opportunity within the past four years of examining one recent specimen, in which, however, the glandular origin was most distinct; and my observation on preparations preserved in spirit has, though not conclusive, tended to confirm this view. In the former case there was a distinct colloid mass obstructing the pylorus, unassociated with any other form of cancer in the stomach, though attended with many polypoid growths from the mucous membrane. Two points of great interest in connection with it were the association with an ordinary epithelioma of the lower third of the œsophagus, which did not show traces of glandular origin, and which was attended by secondary epithelioma of the mediastinal lymphatics; while in the retro-peritoneal lymphatic glands, which lay immediately below the diaphragm (and had probably, therefore, been infected directly from the stomach), I found distinct masses of a medullary character. I think it very possible that the secreting glands of the stomach may undergo this abnormal development in cases where the primary disease has been a scirrhous or medullary growth of the submucous tissue, but I doubt whether any direct *metamorphosis* can take place from either scirrhous or medullary cancer into the colloid variety. A glandular tumor of the pylorus having a structure very similar to what I observed in the case of colloid just quoted, is figured by Dr. Hughes Bennett, Clin. Lect. 1865, p. 495. Its structure is, however, described as thickened, indurated, and white.

[4] These are mentioned by Rokitanski; the largest growth of this kind which I can find recorded is by Loeschner and Lambl, Berichte aus dem Franz Joseph Kinder Spital. That glandular growths may assume all the characters of "malignant" structures is shown

ever originating this form of cancer tends to spread over large surfaces of the mucous membrane, which is thus greatly thickened, and has its normal texture converted into a reticular structure, with spaces filled with "colloid" material. Its tendency to invade deeper issues is also very considerable, and it frequently extends to the peritoneal surface, and thence to the omentum.

In their subsequent course all cancers of the stomach have certain characters in common, marked only by minor shades of variation dependent on their peculiarities of growth.

Changes in the form of the stomach from the contraction of scirrhus have been already alluded to. Diminution in the size of the organ may also occur from obstruction of the cardiac orifice. Dilatation is a very common effect of obstruction of the pyloric orifice; and it is sometimes attended with thickening, at others with thinning of the coats. Thickening when present usually predominates in the muscular layers, which then undergo a true hypertrophy. The size attained under these circumstances by the organ is sometimes such as to fill the whole abdominal cavity, and to extend even to the pubes.

Adhesions are very common to adjacent viscera when the cancer has extended through the peritoneal coat. The most common of these are to the liver, pancreas, omentum, spleen, or diaphragm, or to the abdominal wall.

Displacements, unless prevented by adhesions to neighboring viscera, may be caused by the weight of the tumor dragging the stomach into the lower portions of the abdomen; and under these circumstances it may become fixed by new adhesions in abnormal situations and the pyloric portion may be found in the right iliac fossa, or even in the pelvis, adhering to the intestines, uterus, ovaries, or bladder.

Ulceration is common to all varieties of cancer. It is most marked in the softer medullary forms, when it often takes on the form of sloughing, through which process large masses may sometimes be thrown off, leaving irregularities in the substance of the cancer. The same condition also occurs, but to a less extent, in scirrhus. In colloid, on the other hand, it is seldom observed, and the ulcerative process, if so it can be called in this variety, consists of the rupture of the larger spaces, which thus give rise to a series of pits or depressions on the surface. The more rapid and extensive necrotic processes are sometimes a source of dangerous hemorrhage.

The ulcers thus resulting are almost invariably distinguishable by their thickened, ragged edge, which is infiltrated and swollen by the morbid growth, and around which warty or polypoid excrescences are often formed, and also by the presence of cancer structures in their floor. Occasionally such large masses of the growth are thrown off as to have led to the idea that the morbid structure might possibly be eliminated in this manner; but evidence of a cure thus occurring is very defective, and, although cicatricial formation is sometimes found proceeding in one part, it is usually found that the cancer structures are extending in another. In some cases this sloughing action appears, however, to have restored the patency of the pyloric and cardiac orifices, after these had been previously obstructed by the growth.

The extension of the cancer through the peritoneal coat is attended with various consequences. Adhesions to neighboring organs, and implications of the omentum in the cancerous growth, which are most common in cases of colloid, have been already alluded to.

General peritonitis[1] has sometimes been observed without rupture of the stomach. Partial peritonitis taking place in the same manner is, however, more common.

Perforation, leading to a free opening between the interior of the stomach and the cavity of the peritoneum, is less frequent in cancer than in ulcer of the stomach. The data as to the absolute frequency of this event in the former disease are, however, not sufficiently certain to allow of an absolute comparison.[2]

Adhesions to adjacent organs may, however, lead to the invasion of these by the cancer, as is observed in the case of the liver, pancreas, spleen, and the lumbar vertebræ, or to fistulous communications formed between the stomach and other parts. Gastro-colic fistula has been already stated to be much more frequent in cancer than in ulcer, while the converse proposition holds true with regard to gastro-cutaneous fistula.[3] Perforation of other portions of the intestines has also been noticed, as into the ileum;[4] and

by Remak's observations above quoted, as well as by a remarkable case of Billroth's of a tumor of this nature in the testicle (Virch. Archiv, viii.). The best illustration of this form of cancer is to be found in Cruveilhier's Path. Anat., Liv. x.

[1] Dittrich, loc. cit.

[2] Dr. Brinton has estimated the frequency of perforation in cancer as occurring in rather more than 4 per cent. In four of his cases the contents of the stomach were effused into a limited sac bounded by the peritoneum.

[3] See note 5, col. 2, p. 90.

[4] Brinton, loc. cit. A remarkable case of this nature, which has its parallel among the secondary consequences of simple ulcer, is recorded by Dittrich, Prager Viertel-Jahresch.

in other cases the growth extends through the diaphragm into the lungs.

The mucous membrane of the stomach in parts not invaded by cancer presents little that is characteristic. Evidences, however, of inflammatory action, sometimes existing in an acute form, are occasionally met with, and still more frequently there are seen signs of chronic forms of this process in thickenings and ash-gray pigmentation, with fatty degeneration of the glandular structures. In other cases, again, no deviations from the normal appearance and structure can be found.

The associated pathology of cancer of the stomach may be conveniently considered under the heads of the relation of the growth to similar structures occurring in other parts, and of accidental complications and secondary lesions not associated with the presence of cancerous formation.

The disease in the stomach, unless when propagated by continuity from other parts, is almost invariably primary.[1] Secondary affections[2] more commonly occur in the viscera of the abdomen than in more distant organs.[3] The extension of the growth to other adjacent viscera by adhesions has been already described.[4]

Obstructions of the vena cava and thoracic duct are among the rarer events.[1]

The non-cancerous secondary lesions may be also briefly dismissed, as they offer but few peculiarites in connection with the special organ in question. The occurrence of peritonitis, independently of rupture of the stomach, has been already alluded to. It appears, from the observations of Dittrich, to be sometimes of a septic character, and to be occasionally associated with pleurisy and pericarditis, due probably to a similar mode of origin. Retrograde tubercle was found in the lungs in most of Dittrich's cases. The author only mentions five instances of catarrhal pneumonia as a complication; but it is probable, from the statements of numerous other writers (though precise data are wanting), that a low inflammation of this type is exceedingly common, and frequently proves the immediate cause of the fatal issue. Among the other secondary affections may be mentioned coagulation of the blood in the veins of the extremities, with the phenomenon of phlegmasia dolens;[2] or in the sinuses of the dura mater. Spontaneous coagulation in the arteries[3] is a less frequent occurrence. Its consequences have been already alluded to.

Ulcerations of a non-cancerous nature in the rectum and colon were noted twenty-five times by Dittrich, and endocarditis was observed in five instances.

The blood suffers markedly in its composition, especially when there is much vomiting, and still more so when there is hemorrhage. The anæmia and waxy pallor of the complexion are largely explicable by these events; but that the interference with digestion and assimilation may take place at an earlier stage is shown by cachexia occurring, in a certain number of cases, independently of these events. Analyses of the blood have chiefly been directed to the former class, and show, as might be expected, a diminution in the number of the blood-corpuscles, and also of the total amount of solids in the serum, while the proportions of fibrine have varied, being sometimes in excess of, and at others below, the normal standard.[4]

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xix. 112, where a fistulous opening was established between the stomach and duodenum after the pyloric opening had been obstructed by the cancerous growth.

[1] Walshe, loc. cit. 279. It may occur among the phenomena of simultaneous multiple developments of the growth, and under these circumstances has been found to coexist with similar disease in the ovaries and uterus. An almost unique case has been recorded by Cohnheim (Virch. Archiv, xxxviii. p. 142), when cancer was found in the stomach secondarily to a similar affection of the mamma. The liver and the axillary and cervical lymphatics were also implicated.

[2] These are found in about half of the cases of cancer of the stomach. The liver suffers in 25·6 per cent. of all cases (Brinton, Dittrich). In 160 cases given by Dittrich, the liver was affected 43 times; the peritoneum 22; the lungs 9; the rectum 2; and the ovary once. Brinton says that the lungs were affected in 8½ per cent., and the gastro-lymphatic glands in 25½ per cent., of 251 cases. Dittrich says of the latter, that it is only those in immediate proximity to the stomach which ordinarily suffer. Henoch, loc. cit. ii. 162, says that cancerous glands above the clavicle may sometimes aid in the diagnosis. Dr. Handfield Jones, loc. cit. 169, has given a case where the glands behind the stomach thus secondarily implicated contained columnar epithelium.

[3] Dr. Walshe says that he has never known the lungs to suffer in this manner without implication of the liver.

[4] In some cases the disease appears to spread by dissemination or contact, without adhesion, as in a case of Sir R. Carswell's, cited by Dr. Walshe, loc. cit. p. 282, where a cancerous tumor existed in the anterior abdominal wall, over, but otherwise unconnected with, a similar formation in the pylorus; and an illustration of a similar and very extensive process of dissemination over the peritoneal surface is given by Virchow, Krankhaften Geschwülste, i. 54.

[1] Dittrich, loc. cit.

[2] Nine times in 160 cases: Dittrich.

[3] Twice in 160 cases: Dittrich.

[4] Andral et Gavarret, Rech. sur la Composition du Sang, p. 238. I have in one case

Diagnosis. — Cases of cancer of the stomach may be, as has been before stated, divided into two classes—one when the disorder runs an almost latent course, and is revealed only by failure of health and strength, by obscure dyspeptic symptoms, and by anorexia: another when it gives rise to either pain, vomiting, and hemorrhage, singly or conjointly, and in which, at some period, a tumor can be recognized.

The former of these classes is with great difficulty distinguished from cases of atonic dyspepsia, and from some of chronic catarrh. The latter may be confounded with neuralgic conditions of the stomach, with colic, or with gastric ulcer.

It may be stated that the discovery of tumor distinctly situated in the stomach affords the only *positive* ground for the diagnosis of cancer from some other diseases of the organ. This, however, is not early apparent, and it may at times disappear, and the probability of the cancerous nature of the disease must then rest upon other data, which relatively are only of comparative value.

1. The diagnosis of the first class has been already alluded to (see Atonic Dyspepsia). The etiological conditions under which the symptoms originate are of extreme importance in estimating the nature of the disorder. If such a condition should appear without manifest cause after the age of thirty-five or forty, it is sufficient to excite suspicions of its real nature, especially if loss of appetite form a prominent feature. The addition of vomiting to the above, even if unaccompanied by pain, when alcoholic excesses, albuminuria, or cirrhosis of the liver can be excluded, would add additional gravity to the suspicions entertained, since both atonic dyspepsia and simple chronic catarrh are rarely associated with this symptom, except (in the case of the latter) under some of these attendant circumstances.

2. In cases where pain forms a prominent feature, unaccompanied by vomiting, by marked disturbance of the digestion, or by hemorrhage, and when no tumor can be discovered, the diagnosis from *purely neuralgic conditions* must also mainly depend on etiological circumstances, since the characters of the pain in both these classes of disease bear a great similarity to one another, being in both usually unaggravated by food, and not associated with tenderness on pressure. Sex is one of the most important of these; sex and age collectively may, in cases where the combination occurs in a male past middle life, be of great importance, for neuralgic pains of the stomach are rare under these circumstances, being most common in females at the earlier periods of life. In the female sex these conditions afford less assistance. When the climacteric period is past, and the hysterical diathesis can be excluded, there may, under such circumstances, be some grounds of suspicion, but certainly can rarely be attained without some of the concomitant phenomena before alluded to.[1]

3. A third class, of gradual and progressive emaciation, without distinct causes of marasmus, occurring at middle life, though unattended by any distinct stomach symptoms, should also engage attention. The manner in which cancer of the stomach can thus profoundly impair the nutritive processes, though completely unexplained,[2] has nevertheless been distinctly recognized.

4. In the absence of a tumor, the diagnosis of cancer from *ulcer* of the stomach is sometimes a question of difficulty. In the majority of such cases the diagnosis is rather a balance of probabilities than a question of absolute certainty, which, however, may be attained with a greater or less accuracy in a certain proportion of instances.

Common to both diseases are the symptoms of pain, vomiting, hemorrhage, and cachexia, and disturbances of digestion and of the secretions of the stomach, but they appear in a different manner, and at different periods of the two disorders.

The circumstances influencing the diagnosis may be briefly contrasted as follows:—

Etiology.—Ulcer is more common at the earlier periods of life, and especially so in the female sex: cancer is almost limited to the later periods of life, and its appearance is comparatively uninfluenced by sexual conditions. The pain frequently presents in both disorders a paroxysmal character, but in cases of cancer it is usually more continuous, is less influenced by food, and is less frequently relieved by vomiting. The specific character of the pain affords no positive data for distinction in either disease.

Tenderness on pressure is most common in earlier stages of ulcer. It is rarer in a localized form in cancer until a tumor has appeared, and even under these circumstances it is less distinct. The position of either disease in the stomach

observed a distinct increase of the white corpuscles of the blood, but there was in this instance a considerable non-cancerous enlargement of the spleen.

[1] Constant and repeated experience has shown that such cases are not merely hypothetical.

[2] The condition is evidently something more than the so-called cancerous cachexia, which is rarely, if ever, observed in cancer of external parts until ulceration has set in, or unless pain has been severe.

necessarily influences the diagnosis in this respect.

Hemorrhage is, on the whole, rather more frequent in cancer than ulcer, but the amount of blood effused varies considerably in the two disorders. Large hemorrhages are much the most frequent in ulcer,[1] while smaller hemorrhages of coffee-ground or sooty matter mixed with mucus are most common in cancer. Hemorrhages in the earlier stages are much rarer in cases of cancer than of ulcer. Hence, in any given case, the entire absence of hemorrhage is somewhat in favor of ulcer; the presence of small hemorrhage alone is in favor of cancer; and the presence of large hemorrhage alone, or occurring early in the disease, is in favor of ulcer.

Cachexia and failure of strength is a much earlier symptom in cancer than in ulcer. In the latter it is usually proportioned to the pain, hemorrhage, or vomiting; in the former it occurs more or less independently of these conditions. The character of the cachexia appears *per se* to offer but few positive criteria.

The appetite often presents a marked difference. It is often absent or capricious in cancer; in ulcer, on the other hand, it is frequently excessive.

Pylorus and acidity, and the vomiting of glairy mucus, and conditions of indigestion, flatulency, and constipation, are common to both diseases, and offer but few distinctions, but they are somewhat more distinct in the early stages of cancer than of ulcer.

The duration and course of the two disorders are, however, markedly different. That of ulcer may be almost indefinite. It is interrupted by long intermissions, and seldom presents a distinct uniform deterioration of the health and strength. The progress of cancer, on the other hand, from the period that the more distinct symptoms have declared themselves, is rapid, tending to a fatal issue within one or two years. The intermissions, also, when they occur, are of shorter duration, and are seldom complete. Exceptional instances at times occur, but they are insufficient to invalidate the general rule observed.

Perforation of the colon is, as before stated, in favor of the cancerous nature of the disease.

Dilatation of the stomach and obstruction of the orifices, together with the vomiting of sarcinæ, when occurring to any marked extent, are more common in cancer than in ulcer; but this, like other points of comparison, is only true as a question of degree.

[1] They occur in one-third of all cases of ulcer, and in about 1 per cent. of cases of cancer (Brinton).

5. After the appearance of a tumor, the diagnosis becomes more definite; the fallacies, however, of its position and occasional disappearance, which have been before alluded to, require to be recollected. Ulcers of the anterior surface and of the pyloric extremity are occasionally attended with a degree of thickening, which may give rise to a fallacious sensation of a tumor; but in these cases the induration is not so distinctly circumscribed, nor is the resonance on percussion so absolutely dull, as in cases of gastric cancer. The other peculiarities arising from the infiltration of the coats in the latter disease have been before described.

Other fallacies, however, exist in cases of cancerous tumors of the lymphatics, of the small omentum, of the liver, of the head of the pancreas, and of the peritoneum and great omentum, which may at times perforate the stomach from without. When this event does not occur, the diagnosis must depend on the absence of the more prominent symptoms referable to the stomach; if the stomach is implicated, the diagnosis must become practically almost impossible without further details in the history of the case, which lie beyond the scope of this section.

It is only necessary to allude briefly to the possible fallacy of spasm of the first division of the rectus muscle simulating a tumor. This can be distinguished by its quadrangular shape, its superficial character, and by the resonance on percussion; which, however, is sometimes masked by the tension of the muscle.

6. The diagnosis of the pain of cancer of the stomach from attacks of *colic* is often, in its earlier stages, one of great difficulty. The distinction mainly depends upon the same data as serve to distinguish attacks of the latter affection from cases of ulcer (see p. 942).

THE TREATMENT of cancer of the stomach can, unfortunately, be only palliative. In their main features the indications are almost identical, both in diet and medicinal treatment, with those laid down for cases of ulcer; but as food has less influence on the pain, a rigid diet is not to be persisted in so strenuously, when it fails to relieve. Still, however, small meals of easily assimilable food, presented for the most part in a fluid form, prove in many cases very advantageous; a moderate use of alcoholic stimulants is, however, in most cases beneficial. For the relief of pain, opium is the most effectual remedy, and in some cases, when the growth has formed adhesions with the anterior wall, I have found hypodermic injections of morphia of great benefit. Fomentations, leeches, and even blisters to the epigastrium, are also of service. Vomiting is most effectually controlled by

ice; but effervescents, hydrocyanic acid, and creosote may at other times be employed with advantage. Offensive eructations associated with sloughing of the tumor are often mitigated by the use of charcoal.

Dr. Walshe states that he has found a combination of trisnitrate of bismuth with extracts of hop, conium, and stramonium in pill, more useful than any other medicine. He also recommends the oil of cajeput for the relief of flatulence. Constipation may be remedied by enemata, but purgatives by the mouth should be as far as practicable avoided.

The treatment of hemorrhage must be conducted on the principles already laid down. The vomiting of sarcinæ may at times be controlled by the administration of the alkaline hyposulphites.

VIII.—Hemorrhage from the Stomach.

Synonym.—Hæmatemesis.

Hemorrhage from the stomach is usually only a symptom or a result of some other disease of the mucous membrane, or of a condition of congestion induced by disorders in the portal circulation by causes extrinsic to this viscus. It will only, therefore, be necessary to give a brief retrospect of these, many of which have been already alluded to.

Recent researches have indeed proved that the older theories of hemorrhage by exhalation are not altogether so incorrect as they have been lately believed to be, and that in cases of congestion from mechanical causes an escape of the blood-corpuscles from the capillaries is possible. In most cases, however, of this nature as affecting the stomach, the rupture of the minuter vessels of the mucous membrane must be regarded as the most probable condition; since the large hemorrhages arising from cirrhosis of the liver or diseases of the portal system can scarcely be explained by a simple transudation. The pallor of the mucous membrane found in some cases after death affords no argument against this explanation, nor does the fact that no source for the effused blood is discoverable. The causes of this post-mortem pallor, when congestion has pre-existed, have been already considered.

In some cases the rupture of the capillaries is associated with hemorrhagic erosions, the appearance of which has been already described.[1]

Hemorrhages from the stomach may, therefore, be divided into two main classes, viz.: (*a*) those in which it proceeds from larger vessels, and (*b*) those in which it is derived from capillary sources.[1]

Perforation of large vessels may arise from mechanical causes,[2] or from the rupture of vessels through atheromatous changes;[3] but the most frequent, if not the exclusive, sources of hemorrhage of this kind arise in the progress of the chronic ulcer and of cancer, to which no further allusion appears necessary.

Hemorrhage from congestion may arise when this is simple and passive. It is a very common complication of obstructions of the portal circulation, especially by cirrhosis or acute atrophy of the liver, or by thrombosis of the portal vein,[4] which are among the conditions which give rise to the largest hemorrhages from this cause, and some of which have been found attended by a varicose condition of the veins of the stomach. Diseases of the heart and lungs, and asphyxiating conditions, such as epilepsy[5] and strangulation, are also causes of hemorrhage less extensive in amount than those before cited. It is probably to obstructions in the portal, cardiac, or pulmonary circulation that the hæmatemesis and melæna of newly-born children are due, though in some cases the existence of a deficiency in the nutrition and elasticity of the capillaries is evidenced by the coexistence of a hemorrhagic diathesis, either hereditary or not.[6]

In other cases, also, there is probably in addition to congestion, some alteration in the coats of the capillaries, as in diseases of the spleen, where, however, the mechanism of its origin is not fully explained.[7] In the same manner are proba-

[1] See Dr. Bastian, Trans. Path. Soc. vol. xix. 1868.

[1] Another and rarer cause has been noticed in the bursting of an aneurism of the cœliac axis into the stomach (Bamberger, loc. cit. 246).

[2] As in the case of a cork swallowed; Velpeau, Mém. Acad. de Méd. (Budd, 277).

[3] Copland, Med. Dict. ii. 93.

[4] For illustrations of all these forms, see Frérichs, Dis. of the Liver. An interesting case of hemorrhage, from portal thrombosis, is recorded by Dr. Andrew Clark, Path. Soc. Trans. 1867, p. 61.

[5] Budd, loc. cit. 51; Yellowly, Med.-Chir. Trans. iv.

[6] A very complete account of this affection is to be found in Barthez and Rilliet, Malad. des Enfants, ii. 309.

[7] When the hemorrhage occurs in connection with disease of the spleen, it has usually been associated with enlargement of that organ, as the result of ague; but a case of hæmatemesis is given by Dr. Watson, Edin. Med. Journ. June, 1858, where, in addition to splenic enlargement, there was an abnormal distribution of the splenic vein, together with an obstruction from phlebolithes in its exterior. In a large number of these cases

bly produced the hemorrhages of yellow fever, and of other malignant intermittents, as also those which occur in relapsing fever,[1] typhus fever,[2] cholera,[3] purpura, scurvy, and hemorrhagic variola.

In other cases, though probably referable to the same source, its mode of origin is less explicable; as when it follows severe surgical operations,[4] or blows upon the back or epigastrium,[5] or even a remarkable case reported by Empis where the invasion of tubercular meningitis was associated with uncontrollable vomiting with hæmatemesis.[6] In the same class belong also hæmatemeses, occurring vicariously, of the menstrual period, which, however, when independent of ulceration, seem to be less frequent than was at one time supposed.[1] In other cases, also, it may arise through the mechanism of embolism and thrombosis. (See Ulcer.) [Hysteria is not unfrequently attended by hæmatemesis, as one of its symptoms, even without amenorrhœa.—H.]

Diagnosis.—It must be recollected that blood vomited does not always proceed from the stomach, but may have been swallowed after having been effused from the nose, mouth and throat, œsophagus, or lungs. The characters vary with the amount and rapidity of the hemorrhage, and with the length of time which it has remained in the stomach.

In larger hemorrhages, when the blood is rapidly poured into the stomach and quickly ejected, it may be coagulated, and may retain its normal color, or may be only slightly blackened by the gastric juice.

Blood more slowly effused is acted on by the gastric juice, which prevents its coagulation, and frequently dissolves the envelopes of the red corpuscles, so that under the microscope only flakes or granules of pigment may be discoverable. In other cases the corpuscles are shrivelled, and irregular in form and size. The color of the blood is then changed to a rusty chocolate brown or coffee-ground tint, and it is sometimes of a tarry consistence. Sometimes the altered corpuscles and pigment granules sink to the bottom of the vessel, leaving a clear supernatant fluid.

The presence of the blood can, however, be generally recognized: for bile seldom loses its more characteristic tint, nor does it assume the coffee-ground appearance just described. Food stained by ferruginous medicines will sometimes present a similar appearance; but microscopic and, if need be, chemical examination will then suffice for its distinction.

Blood, however, effused from the stomach is not invariably vomited, but may pass into the intestines and be voided by stool (melæna).

Difficulties may, under such circumstances, arise in deciding from what portion of the canal the blood has proceeded. Independently of distinct evidence of local disease, this may not always be possible,

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the liver is simultaneously diseased; but that this is not always present is shown by a case by Dr. Budd, loc. cit. p. 70. The cause in some cases is probably a complex one, for other hemorrhages, as into the skin (Piorry), or from the nose, which was noticed by Hippocrates (Ἐπιδημίων, ii. § 165, Kuhn's Ed. iii. 450), are very common. These have also been witnessed by recent observers, as by Bamberger, loc. cit. 654; and though it is difficult to believe that any alteration in the composition of the blood, except when attended with complete breaking down of the red corpuscles (which has not been shown to take place), can permit of its escape from the capillary walls, yet it is very probable that the nutrition of the vascular system may, in these cases, be so profoundly affected as to cause their easy rupture under slight pressure. In some cases, as believed by Siebert (Henoch, loc. cit. i. 54), the contractility of the splenic tissue may contribute to the result, as a rapid diminution of the size of the spleen has been observed after copious hemorrhage of this nature.

[1] Murchison, Continued Fevers, pp. 336–7.

[2] Buhl, loc. cit. 68.

[3] Buhl, Report of the Munich Commission on the Cholera Epidemic of 1854, p. 500.

[4] A case of this nature was communicated to me by my friend and colleague, Mr. Berkeley Hill, when after an operation severe hæmatemesis occurred, for which after death no cause could be discovered. Sir W. Jenner informs me that he has seen similar instances. In relation to it may be recalled the observations of Rokitanski upon hemorrhage from the bowels after severe burns (Path. Anat. iii. 200).

[5] Dr. King Chambers, Indigestions, p. 190. Bamberger, loc. cit. 245. Another is quoted by Henoch, i. 307. It is possible that, in some of these cases, laceration of the mucous membrane, without rupture of the other coats, may be the cause of such hemorrhage. An instance of this nature is recorded by Dr. Wilks, Path. Anat. 1857, p. 275. Laceration of the *mucous membrane* of the stomach from the dragging of an omental hernia is described by Rokitanski, Path. Anat. iii. 162.

[6] De la Granulie, p. 154.

[1] A very remarkable case of this kind is, however, given by Sir T. Watson, Prin. Pract. Phys. ii. 425, where vicarious menstruation recurred regularly, ceased with pregnancy and lactation, and returned after weaning. He quotes also from Mr. North two other fatal cases. Dr. Murchison has cited another of older date (1712), Med.-Chir. Trans. xli. p. 46; and Henoch, loc. cit. i. 57, has observed the same phenomenon coincidently with an acute swelling of the spleen, which disappeared after hemorrhage from the stomach and intestines.

since blood proceeding from the upper part of the intestines has usually the same characters when voided by stool as that derived from the stomach. Blood from the duodenum may also be regurgitated into the stomach, and be evacuated by vomiting.

Cruveilhier was of opinion that blood effused from the stomach retained its rusty tint throughout, while that originating from the intestines was of a more inky character; but this distinction is not always applicable. The chief means of distinction depends on the more or less intimate intermixture of the blood with the fecal matter, which diminishes in proportion as its source approaches the lower portion of the canal.[1] The existence of disease in the latter (ulcerations from tubercle, typhoid, dysentery, cancer, or the presence of hemorrhoids) also facilitates the diagnosis. In some cases, as in disease of the liver, we must often remain in doubt, since this cause may give rise to hemorrhage from any part of the tract.

The characters of altered bile in the stools are to be distinguished by dilution with water. Blood under these circumstances gives a redder tint.[2] Bile pigment can sometimes be distinguished by nitric acid; but bile seldom produces either the tarry or rusty appearance derived from altered blood.

The blackening of the feces from ferruginous and other metallic preparations can usually be distinguished by the tint, and also by the history of the case.

The distinction between hemorrhage from the lungs and that from the stomach is not always easy. Difficulty may arise either when blood is vomited immediately after its effusion in the stomach, so as to escape changes from the gastric juice, or when that proceeding from the lungs has been swallowed, and subsequently vomited in an altered condition.

In some cases, also, of mitral disease, blood proceeding from the lungs has been known to present a "bistre" or sooty tint.[3] In exceptional instances there may also be a double fallacy in the expulsive act attending each condition, for hæmatemesis may sometimes give rise to cough, and hæmoptysis may occasionally excite vomiting. The criteria ordinarily laid down are, however, usually sufficient when a patient is under observation, though it is sometimes more difficult to draw positive conclusions from the history of past attacks.

Blood proceeding from the lungs is generally frothy, aërated, non-coagulated, florid in color, and alkaline in reaction.

That derived from the stomach is either blackened and rusty, or it may be coagulated and altered externally. If it has been at all delayed in the viscus, and unless it is in excessive quantities, it is acid.

Hemorrhage from the lungs is preceded or attended by a sense of weight and oppression in the thorax, together with a sense of dyspnœa and tickling cough, or with a sense of bubbling in the chest. Tinged sputa often precede and almost constantly follow the larger flow, and these are brought up by coughing, are frothy and aërated, and mixed with mucus or pus. It may be the first symptom in a certain proportion of cases,[1] but physical examination of the lungs and heart will, almost without exception, disclose evidence of disease in these parts.

Hemorrhage from the stomach is seldom, if ever, the *first* symptom of disease of this organ. It has usually been preceded by dyspeptic symptoms, or in the vast majority of instances by pain, nausea, or vomiting. The attack is preceded by nausea, and the expulsive act is almost invariably distinctly one of vomiting; it is not followed by cough or bloody sputa. Examination of the abdomen will usually reveal gastric tenderness, or the signs of disease of the liver or spleen.

The diagnosis of the disorders of the stomach in which the hemorrhage originates must be determined by their distinguishing features, which have been previously considered.

THE SYMPTOMS of hemorrhage from the stomach have been already described (see Ulcer of the Stomach).

PROGNOSIS.—Severe hemorrhages from the stomach are occasionally directly fatal; the author's conviction is, that this is more frequently the case when they arise from cirrhosis of the liver than when originating from ulcer or cancer of the stomach. In the latter disorders, however, they contribute largely to a finally fatal result by the exhaustion and anæmia which they induce.

THE TREATMENT consists of rest and the administration of hæmostatics.

In some cases, when the hemorrhage proceeds from congestion through obstructed venous return, particularly when the cause resides in the liver, it is benefited by purgatives;[2] but these are strongly contraindicated in cases of ulcer and cancer. With the above exceptions, cold and astringents must be resorted to. Ice, in small pieces, may be sucked constantly. Turpentine, acetate of lead, tannic acid, the perchloride of iron [creasote.—H], or

[1] Bamberger, loc. cit. 252.
[2] Ibid. 251.
[3] Walshe, Diseases of the Lungs, 416.

[1] See Ibid.
[2] Sir T. Watson, loc. cit. ii. 435.

alum,[1] or the infusion of matico, may also be tried. My own experience leads me strongly to prefer the acetate of lead in the majority of cases.

When the hemorrhage is severe, the head must be kept low. Brandy may be administered by the rectum, or ether inhaled. If temporarily arrested, abstinence from food should be practised as completely as possible for some time, and nutriment should only be given in a fluid form, in very small quantities, and cold, so as to avoid both the afflux of blood during the digestive act, and also all movement of the stomach.

IX.—Hypertrophy of the Walls of the Stomach.

Synonyms.—Cirrhosis; Plastic Linitis (Brinton): Fibroid Induration (Handfield Jones); Sclerosis (Snellen).

Thickening of the coats of the stomach appears to be a rare disease, and one that is at present but little associated with any definite group of clinical symptoms. It is also one regarding which much confusion has existed, and on the nature of which some doubt still remains in the writings of pathologists.

Andral, who furnished the first systematic description of it,[2] confounded it with scirrhous induration; or, rather, he described that form of cancer in the stomach as consisting only of a thickening of the coats of the organ, induced by chronic inflammation—an opinion which has been further supported by Bruch.[3] Hypertrophy of the muscular coats is a common result of pyloric obstruction.[4] Cases of general thickening to any extreme degree of the coats of the stomach, independently of such causes, though occasionally met with, are nevertheless of extreme rarity.

Thickening of the mucous membrane from chronic catarrh has been already described; but this condition does not usually invade the submucous tissue, nor is the muscular coat generally affected.

In the cases, however, described under this head, a general thickening of all the coats ensues, which, however, especially affects the muscular and submucous layers. In some cases this is found more particularly in the pyloric region, under which circumstances that orifice is usually considerably narrowed. In other instances it implicates to a greater or less degree the whole of the organ.

In some cases the thickening has apparently resulted from abnormal growth of fibrous tissue, which has indurated the coats, and caused wasting of the muscular substance, but in which no evidence of a cancerous nature has been found by microscopic examination.[1] Rokitanski considers that this change may sometimes be the final result of suppurative inflammation in the submucous tissues.

The coats of the stomach may, under these circumstances, attain a thickness of an inch or an inch and a half. The mucous membrane is thrown into folds, and in some cases has been found thinner than natural (Dr. H. Jones). The cavity of the stomach, in a case recorded by Dr. Hare, was much contracted, so as only to contain about four ounces of fluid.

The symptoms in the recorded cases have varied, and have been complicated with the presence of ascites (Dr. Wilks), and with recent peritoneal inflammation (Dr. Hare and Dr. Wilks); or, when the disease has been limited to the pylorus, with the signs of obstruction. Vomiting, which has sometimes been attended with the ejection of matter of coffee-ground appearance, has been noticed in some instances; and pain, but not of a severe kind, has usually been present. Gradual emaciation has also been observed. The cases have generally been chronic; in some instances proceeding to a fatal termination in two or three years. In some cases the stomach has formed a distinct tumor, perceptible through the parietes, but which has, however, been resonant on percussion (Louis and Dr. Hare).

The causes of this condition, independently of the observation of Rokitanski, are very obscure, and, from its extreme rarity, the disorder must be considered at present to be one which presents features rather of pathological than of clinical interest.

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[1] Ammonio-ferric alum is the most acceptable to the stomach.—H.]

2. Prec. Path. Anat.

3 Zeitsch. Rat. Med. 1849.

Louis, Rech. Anat. Path. p. 121 et seq.

1 See a case of this kind reported by Dr. Hare and examined by Dr. Lionel Beale, Path. Soc. Trans. iv. 129. Another case reported by Dr. Quain, but in more doubtful terms, is in the same volume. Another case is reported by Dr. Handfield Jones, Stomach, p. 121. A preparation of great hypertrophy of the muscular and subserous coats, with no history attached, is in the museum of University College. Four cases are also given by Dr. Hughes Bennett, Cancerous and Cancroid Growths; and another by Dr. Wilks, Path. Soc. Trans. xiii. 83. In Dr. Wilks' case a similar change was found in the intestines. Two cases of the affection limited to the pylorus are recorded by Dr. Habershon, Obs. Alim. Canal, 1857, p. 99. Several cases are also recorded by Brand, Ueber Stenosen des Pylorus, Diss. Inaug.; Erlangen, 1851. Also a case by Snellen, Canstatt, Jahresb. 1856, iii. 302, where the disease followed an injury to the epigastric region and affected the whole stomach.

The main features by which it can be pathologically distinguished from scirrhus of the stomach have been already alluded to. (See note 1, col. 2, p. 112.)

X.—Stricture and Obstruction of the Cardiac Orifice of the Stomach.

Synonym.—Stenosis of the Cardia.

This affection is comparatively rare, except when caused by cancerous growths occluding or contracting the orifice. Simple spasm appears occasionally to cause temporary obstruction of this nature. It may, however, result from the cicatrices of simple ulcers, or of such as have been caused by swallowing corrosive poisons. Foreign bodies impacted at the cardiac orifice may, it is said, act as a cause.[1] Obstructions may also result from aneurismal or other tumors pressing on the œsophagus at any part of its course. The symptoms of such pressure are almost identical with those of occlusion from disease of the canal.

The primary effect of these obstructions is the regurgitation of food into the mouth. The secondary consequences are those of starvation, proceeding more or less rapidly according to the degree of obstruction present.

The regurgitation into the mouth of the food delayed at the cardia takes place by an act resembling vomiting. The characters of the food thus returned depend on the degree of obstruction, or on the amount of dilatation which the œsophagus has undergone.

When the obstruction is incomplete, fluids may pass when solids are returned. A degree of spasm, or sometimes of paralysis, is often combined with the mechanical obstacle, since the facility of swallowing varies at different periods; and a narrow tube can sometimes be passed through the obstruction, by which patients may be fed, when all the food appears to be regurgitated. When dilatation of the œsophagus has not ensued, the food is very quickly returned, almost unaltered, except by mastication. When, however, the increased calibre and diminished muscular powers of the œsophagus above the seat of the obstruction admit of its retention, it becomes changed by maceration, or it may underg fermentation or putrescent changes, which give rise to offensive eructations, and the matters ejected are often covered or mixed with a quantity of tenacious mucus.

Pain is generally felt, especially during deglutition; it is commonly referred to the ensiform cartilage or mid-dorsal region. The pain is seldom very severe, except when ulceration is present. In the intervals of deglutition there is often a dull sense of uneasiness. In many cases the patients are distinctly conscious of the point where the passage of the food is arrested.

The passage of a bougie will almost certainly indicate the point of obstruction; but this should be cautiously practised, owing to the danger of laceration of the œsophagus. The appetite is unimpaired, and patients often suffer intensely from hunger and thirst. Emaciation proceeds *pari passu* with the degree of obstruction. Dropsy of the lower extremities supervenes in some cases. Hectic is occasionally observed.

The termination is almost invariably fatal, except in cases of simple cicatricial narrowing, where dilatation may sometimes be practised. Death finally ensues by asthenia, or by pneumonia, or gangrene of the lung, or by rupture of the œsophagus.

The Pathology of these cases depends on the discovery of the cause. In most instances of cancerous obstruction of the orifice the obstruction is due to scirrhus. Higher in the œsophagus, epithelial cancers are an equally frequent cause.

The stomach, in the later stages of the disease, is often greatly diminished in size, so as not to exceed that of the intestines. No special alteration of its mucous membrane has been recorded.

The Diagnosis of the obstruction is usually easy. It is determined by the character of the food regurgitated, by the obstruction felt in swallowing, and by auscultation during the act of swallowing. The passage of the bougie serves to distinguish between the effects of organic stricture and of simple spasm, and also to determine the site of the obstruction. Percussion will occasionally ascertain the existence of dilatation of the œsophagus. The diagnosis of the cause of the obstruction must in a great measure depend upon the history of the case. Spasmodic obstruction is intermittent, and is almost invariably associated with the hysterical diathesis. Simple cicatricial contractions are very rare, except when corrosive fluids have been swallowed. The regurgitation of blood or pus,[1] or in rarer cases the discrimination of cancer cells in the matters vomited, would indicate, in all probability, the malignant nature of the obstruction.

[1] Bamberger, loc. cit. The author desires to express his obligation to this writer for much of the systematized information contained in this and the ensuing section.

[1] Dr. King Chambers: see *ante*, Vomiting.

THE TREATMENT consists in administering food of nutritious properties in a liquid form. The fact that, in some cases, a tube can be passed, will suggest this mode of giving nourishment. Nutritive enemata may also be administered. Thirst may in some persons be allayed by baths. Opium is also of value in diminishing the sufferings of the patient; it may be given in small quantities by the mouth, by enemata, and by the hypodermic method. Dilatation may in some cases be successful, when the stricture is clearly traceable to cicatricial contractions resulting from corrosive poisons. Dilatation by the bougie, bismuth, the valerianate of zinc, small doses of strychnine, bromide of ammonium, and iron, are useful in hysterical cases.

The attempt to relieve the patient by gastrotomy and the establishment of a gastric fistula has not hitherto proved successful, but it would appear on many accounts deserving of a trial; though in the majority of the cases which result from cancerous growths, the fatal termination could only be delayed by such a procedure.[1]

XI.—STRICTURE AND OBSTRUCTION OF THE PYLORUS. DILATATION OF THE STOMACH.

Stenosis, Constriction, and Obstruction of the Pyloric Orifice are comparatively rare, independently of obstructions from cancers and other tumors of the mucous membrane, or from the cicatrices resulting from the healing of ulcers, or sometimes from the effects of corrosive poisons.[2]

Pyloric stenosis may, however, result from the induration of the submucous tissue described in a previous section, which may affect the stomach throughout, or may be limited to the pyloric ring. It appears also, occasionally, to result from hypertrophy of the muscular coats limited to this portion of the organ, a form of disease which, as stated by Dittrich, appears to occur with preponderating frequency in the earlier periods of life.[3]

Whether *spasm* can continue sufficiently long to produce any of the more serious symptoms resulting from organic disease must be regarded as very questionable.

Obstruction to the exit of food from the stomach may also arise from pressure upon the pyloric orifice or first part of the duodenum, by tumors originating externally to the organ. The most common of these are cancerous growths in the pancreas, in the lymphatics of the small omentum, and in the liver. Cancer of the gall-bladder has also been observed to produce this effect.[1]

THE SYMPTOMS are essentially those resulting from obstruction to the passage of food from the stomach, though varied by those of the other diseases in which the obstruction has its origin.

Vomiting is the most distinct and prominent of these. Its appearance is not necessarily indicative of absolute closure of the pylorus, for Bamberger has observed it to occur in cases where the orifice would still admit of the passage of the little finger.[2] Its character and time of appearance, however, greatly depend on subsequent changes in the stomach, and especially on the degree of dilatation which the organ undergoes—a condition which, as it may occur (though rarely) independently of pyloric obstruction, requires a separate description.

DILATATION OF THE STOMACH.

Dilatation is a common and almost constant result of constriction of the pyloric orifice, unless this is counterbalanced by muscular hypertrophy. It may, however, result independently of any obstruction to the pylorus, under certain circumstances, which deserve consideration. Thus:—

(*a*) Weakened conditions of the muscular coats, arising from malnutrition or impaired innervation, are a very common cause of not inconsiderable dilatation of the stomach. Such conditions arise in the course of severe general disease, such as fevers, or from local causes in cases of peritoneal inflammation. They are also common in cases of hysteria, hypochondriasis, and in some diseases of the cerebro-spinal centres, and also in some instances when the probability of one or other of the latter class of causes having existed is rather a matter of inference than of positive proof.[3]

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[1] A successful case of gastrotomy, undertaken to remove from the stomach a bar of lead which had been swallowed, is recorded by Mr. Bell, Med. Times and Gaz. March 31, 1860. Another for the removal of a knife is quoted by Mr. Gray, Holmes' Syst. Surg. ii. 338. In this article a tabular statement is given of the cases where this operation has been attempted.

[2] Dr. Markham, Path. Soc. Trans. x. 160, relates a case of obstruction of the pylorus as a secondary effect of swallowing Burnet's fluid.

[3] Brand, loc. cit. p. 15.

[1] Dr. Markham, Path. Soc. Trans. viii. 243.

[2] Bamberger, loc. cit. 253.

[3] See an interesting case of this class by Dr. Humby and Mr. Miller, Path. Soc. Trans. iv. 137. The invasion of the disease was comparatively sudden. There was vomiting,

(*b*) Paralysis of the muscular coat, limited to the pyloric portion and preventing the propulsion of food into the duodenum, has also been observed to cause secondary dilatation of the stomach.[1]

(*c*) In addition to these causes, obstruction of the duodenum, or even of the upper portion of the jejunum,[2] has been followed by the same result. Excessive eating of vegetable food has been described as a cause by Dr. Hodgkin.[3] Dislocation of the stomach and dragging of the viscus by omental hernias are mentioned as causes by Bamberger.

The symptoms of this condition are divisible into two classes: firstly, the evidence of the delay of the food for an unnatural period in the stomach; and, secondly, the physical signs resulting from the dilatation of the organ. It is only in comparatively rare cases that the dilatation, when proceeding from other causes than pyloric obstruction, is accompanied by the severer objective symptoms, and, with a few exceptions, the description of these refers almost exclusively to this class.

The immediate result of the retardation in the propulsion of the food is the production of fermentative changes; which are evidenced both by the tympanitic distension of the organ, and by the matters vomited. The nature of the changes thus undergone by the food, and the products of these, have been already considered. (See *ante*, p. 21.) The matters vomited are almost invariably frothy and acid, and in the scum on the surface torulæ and sarcinæ are commonly found.[4] (See *ante*, p. 22.) The alterations in the food vary with the duration of its delay in the stomach; sometimes the last meal is retained, while previous ones are rejected,—a difference probably due to the relatively greater fluidity of the latter. The amount vomited and the length of the intervals between the act also vary in proportion to the degree of obstruction of the pylorus, or to the extent of the dilatation, or of the paralysis of the muscular coats. The vomiting generally occurs at longer periods after eating than in most of the other diseases of the stomach, though sometimes the act is much delayed both in ulcer and gastric catarrh. When, however, the dilatation or paralysis is extreme, days may elapse between the recurrences of this symptom, but under such circumstances enormous amounts of altered food may be ejected.

Bamberger remarks that the vomiting may cease if *complete* paralysis of the muscular coat should ensue.

Eructation and heartburn are often observed to precede the vomiting, and in some cases acidity, apparently resulting from hypersecretion, has been noticed.[1]

The appetite is variable. It is sometimes considerable, or even excessive; but in some cases this is attributable to the vomiting. Emaciation is an almost constant result: the extent to which it proceeds depends on the amount of food retained and assimilated. Constipation is, as might be expected, nearly invariably present. Dropsical swellings of the lower extremities have been seen in some cases.

The physical signs are those of extreme distension of the stomach. The tympanitic note of the organ may be heard over the extent which it occupies, though sometimes, when food is present in its interior, the inferior portions may be dull on percussion, and the dulness may change in site with the position of the patient. The distension may be so great as to push the diaphragm upwards. The tympanitic resonance may reach even to the fourth rib, displacing the heart's apex upwards and forwards. Sometimes the prominence formed by the distended stomach can be perceived by the hand in the epigastric, umbilical, or pubic regions, and the shape of the organ may sometimes be recognized by the smaller curvature being well defined; and in some cases, particularly when there is hypertrophy of the muscular coats, the movements of the organ can be distinctly felt, and may be excited by external stimulants. In some cases the obstructing tumor can be perceived at the

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and the patient died after eleven days' illness. She was seen by several physicians, among others by Sir T. Watson and Dr. Bright. The stomach reached to the pubes; the muscular coat had in some cases given way, but no cause for the distension could be discovered. A somewhat similar case is recorded by Andral, Clin. Méd. ii. 122. See also Dr. Peebles, Edin. Monthly Journal, 1840, vol. liv.

[1] As in a case by Andral, Clin. Méd. ii. 117, where there was extensive ulceration of the pyloric region without obstruction, and yet extreme dilatation of the stomach. The same condition of dilatation was observed in another case, where, in conjunction with induration of the coats of the pylorus, the muscular coat was atrophied, but the pyloric opening maintained its natural size. In this case also there was dilatation. (Ib. p. 115.) Traube, Gesammelte Beitrage, ii. 988, attributes such dilatation to destruction of the branches of the pneumogastric nerve.

[2] Andral, Clin. Méd. ii. p. 129.

[3] Lect. Serous and Mucous Memb. ii. 277.

[4] It would appear not improbable that in the cases recorded by Dr. Budd and Mr. Busk, when sarcinæ appeared without evidence of pyloric obstruction, but in consequence of injury, that the cause of the fermentative action may have been due to a failure of the propulsive power of the stomach, due to paralytic causes.

[1] Bamberger, loc. cit.

pylorus, but this, for the reasons before stated, is not constant.

Auscultation sometimes gives a splashing sound on movement, which, Bamberger says, is one of the best signs of this form of dilatation. In other cases, during drinking, the fluid may be heard and felt by the patient to pass into the large cavity. The heart's sounds may be occasionally heard to consonate in the distended organ.

THE PATHOLOGY of this affection has been already alluded to under its etiology. The size attained by the stomach may sometimes be very considerable; it may fill the greater part of the abdominal cavity and it may reach even to the pubes.[1] The chief point of further practical interest in these cases is the condition of the muscular coat. This may sometimes be thickened, and under such circumstances the affection is less injurious to health than when it is thinned, distended, and paralyzed.

DIAGNOSIS.—That of obstruction of the pyloric orifice, independently of dilatation of the stomach, or of the discovery of a tumor, is surrounded by so many fallacies that certainty would appear to be almost unattainable. The only distinctive symptom is vomiting after food; and unless dilatation is so considerable as to allow of fermentation taking place, the act is seldom delayed to a period capable of enabling a distinction to be made between it and other diseases giving rise to this symptom; for in the female sex the distinction of such cases from hysterical vomiting would be excessively difficult, and it must be recollected that in either sex cancer may run its course without pain. The duration of the case may, however, assist in the diagnosis from cancer.

The discovery of a tumor or of induration in the pyloric region, associated with persistent vomiting, are the only data on which reliance can be placed. The existence of a tumor would raise a presumption that the disease was of a cancerous nature; but a positive diagnosis would scarcely be justified without the presence of some of the more distinctive signs of this disorder.

When dilatation is present, the combination of symptoms and physical signs above given (and which it is unnecessary to repeat) is sufficient for its recognition. Extreme meteoristic distension of the abdomen might be confounded with cases of dilatation not associated with pyloric obstruction, and where vomiting is not a prominent feature. The discrimination may then be made by the methods suggested by Bamberger, of auscultation during the swallowing of liquids, and by the passage of a sound into the cavity of the stomach, in addition to the results of percussion and the splashing sounds audible on succussion of the patient.

PROGNOSIS.—The course and termination of cases of dilatation of the stomach depend very much upon its cause. Simple dilatations, without obstructions, have, however, proved fatal. When resulting from obstruction, the course of the disease is usually prolonged, though its duration is much influenced by the conditions of the obstructions. Obstructions arising from simple thickening or the cicatrization of ulcers have usually a slower progress than is observed in cases of cancer of the pylorus.

The possibility of the reopening of the pyloric ring by sloughing processes in the latter disease has been already alluded to. Bamberger has also seen a patient recover when the obstruction was, in all probability, due to the cicatrix of an ulcer.[1]

TREATMENT.—The treatment of cases of obstruction of the pylorus can be only of a palliative nature.

One main indication is the administration of food in small quantities at frequently repeated intervals. It is also of extreme importance that the food given should be of such a nature that it can undergo its chief metamorphoses by the process of gastric digestion.[2] Hence protein substances, beef-tea, pounded meat, or, possibly, meat already digested, as suggested by Drs. Marcet and Pavy, should form the chief articles of diet. Milk should be used more sparingly. Starchy substances, which undergo acid fermentation, and oily food, should be as far as possible avoided. Nutrient enemata of beef-tea may be used with advantage. The administration of pepsine and hydrochloric acid with the food is also desirable.

Fermentation of the food associated with the vomiting of sarcinæ, which, if permitted to continue unchecked, greatly increases the tension of the stomach, and tends to weaken its muscular coats, may be greatly controlled by the administration of the alkaline sulphites and hyposulphites recommended by Sir W. Jenner.[3]

Creosote and carbolic acid are less use-

[1] This has been observed in cases of dilatation independent of obstruction.

[1] Loc. cit. p. 236, note.

[2] Kuhne has shown that when the pylorus is ligatured, the whole of the food, if suited to the condition of gastric digestion, may disappear from the stomach (Lehrb. der Phys. Chemie, p. 52).

[3] Med. Times and Gaz. Aug. 1851.

ful in this respect; these remedies have appeared to me to be capable of delaying, in some cases, the normal gastric digestion.

Alkalies and antacids are useful in relieving the acidity resulting from the fermentative processes. The other indications for treatment must depend on the nature and character of the obstruction. The chief of these have been already given in the chapters on Ulcers and Cancer.

The indications for the treatment of *dilatation of the stomach occurring independently of pyloric obstruction* may be summarized as consisting in the avoidance of further distension, and in restoring the tone and contractility of its muscular fibres.

Large meals should be avoided, and the food, as in the other form of dilatation, should be digestible and easily assimilable. Fermentation is also to be controlled by the means above indicated;[1] and carminatives, such as cajeput, aniseed, or camomile, may sometimes give relief.

The use of strychnia, and the taking of ice in small quantities, are the methods chiefly to be relied on for the second indication. Iron may also be used with advantage when anæmia is present. Cold douches to the abdomen or spine, and galvanism to the abdomen, would appear to be deserving of a trial.

In addition to these measures, Dr. Kussmaul, of Freiburg, has recently practised with success, in cases of this nature, a method based on the analogy afforded by the beneficial effects resulting from the complete evacuation of the paralyzed and distended urinary bladder, by means of the catheter. Dr. Kussmaul, however, remarks that a true paralysis of the muscular coats of the stomach does not exist in most cases of dilatation, and particularly in those resulting from pyloric obstruction, since in most of these the movements of the distended viscus can be both seen and felt through the abdominal parietes. The power of evacuating its contents is, however, lost; the passage through the pylorus, even when a considerable degree of patency is found *post mortem* to have existed at this orifice, being further impeded by the displacement, and possibly by the torsion, of the opening. Dr. Kussmaul purposes to evacuate the stomach, by means of the stomach-pump, whenever there is evidence of any considerable accumulation of food in its interior, and in particular when vomiting has commenced.[1] It would appear that even a frequent repetition of the act of vomiting may fail under these circumstances completely to evacuate the fermenting contents of the stomach, and that, after it has taken place, a large quantity may still be removed artificially. After the complete evacuation has been effected, Dr. Kussmaul purposes to neutralize the acid mucus, still charged with products of fermentation, by washing the stomach out with Vichy water, and other remedies can thus be applied with a similar object, such as sulphurous acid, solutions of carbolic acid, or borax. Dr. Kussmaul has found this method practically curative in some cases, when from the symptoms present it appeared probable that the dilatation of the stomach resulted from a partial stricture of the pylorus succeeding an ulcer of this part. The muscular power appeared gradually to be restored when distension was thus prevented. The indication for the employment of this measure is considered by Dr. Kussmaul to be the return of vomiting or of regurgitation; but several days frequently elapsed before the necessity for their repetition occurred, the intervals gradually becoming longer in proportion as the muscular coats regained their tonicity. Cases of cancerous stricture were also in some measure relieved by this procedure. The prevention of the distension of the stomach appears to be aided by the application of an abdominal bandage beneath its lower border. Care in diet (of which milk and meat should form the principal ingredients) is necessary to avoid further distension.

[1] Dr. Budd narrates a case where a patient who had long suffered from the vomiting of sarcinæ obtained great relief by taking large quantities of common salt (Stomach, p. 234).

XII.—Softening of the Stomach.

Synonyms.—Post-mortem Softening of the Stomach, Self-Digestion of the Stomach; Gastromalakia; Ramollissement de l'Estomac; Magen-Erweichung. *Var.* Ramollissement simple; R. pultacé; R. gélatiniforme.

Softening of the coats of the stomach has been already described as one of the results of recent inflammatory action. The condition produced by this process has been spoken of as being analogous to the softenings occurring under similar circumstances in other tissues, and the appearances which it presents have been defined as consisting of *swelling* and *in-*

[1] Ueber die Behandlung der Magen-Erweiterung durch eine neue Methode; Freiburg, 1869. The stomach-pump employed is one invented by Dr. Wyman in America, and described by Dr. Bowditch, Amer. Journ. Med. Sciences, N. S. xxiii. 1852, p. 320.

creased opacity of the membrane, together with a diminution of its consistence extending for a variable depth in its substance.

Other forms of softenings are, however, met with, when the membrane is of a pulpy consistence, breaking under the slightest touch; but when, instead of being opaque, it is *transparent*, more or less *gelatinous* looking, and generally, although not invariably, thinner than natural.

The nature and causes of these conditions have been much disputed; and as the opinions held respecting their true character have exercised no inconsiderable influence on the pathology and diagnosis of the disorders of the stomach, it appears desirable to devote some consideration to their real significance and to their mode of origin.

Softening, thinning, and even absence, of considerable portions of the lining membrane of the stomach, had been noticed by Morgagni,[1] but the first attempt to explain these appearances was made by John Hunter,[2] who attributed such changes to the self-digestion of the stomach after death, which he regarded as resulting from the action of the gastric juice on its coats, and which he believed was prevented during life by the influence of the vital principle. He confirmed his observations on the human subject by experiments on fishes, which shortly after received a further support from Spallanzani,[3] who also observed that the digestion of food was continued after death. These observations were continued, and Hunter's views were confirmed by Adams,[4] Allan Burns,[5] Wilson Philip,[6] Gairdner,[7] and Carswell;[8] and there is a considerable uniformity in their descriptions of the appearances observed, and which they attributed to the same cause.

Stomachs in this state present, usually at the fundus, a portion where the membrane is evidently thinner than natural, or is entirely absent over an area of variable extent, while for some distance around it is softened and pulpy. The transparency of the tissue is greatly increased, allowing the white submucous coat to appear through the membrane, while the color varies with the quantity of blood contained in the part. If this is small, the coats of the stomach are of a bluish white; if it is more considerable in amount, they are brownish or blackish. The vessels also may be seen of a blackened color, ramifying through the affected area, and their blackened contents may often be expressed in drops from their eroded ends.

Occasionally, but not commonly, very early stages of this process are observed, when the superficial layers of the mucous membrane are separating in flakes and are much softened, but not wholly dissolved. The surface of the membrane may have, under such circumstances, a somewhat whiter and more opaque appearance, corresponding to the form described by Cruveilhier as the Ramollissement pultacé.

In some cases the membrane is uniformly affected; in other instances, when the stomach is contracted, the softening affects only the prominent rugæ, leaving the intervening sulci unchanged. Occasionally, also, the coats of the stomach and of the intestines are found uniformly swollen, transparent, and jelly-like, having lost all trace of structure, and resembling albumen, or presenting appearances seen in tissues after the action of an acid.

The extent of surface over which the change in question may occur is variable, as is also its precise seat. The whole of the stomach has been found thus softened, but more usually the condition is limited to the fundus or posterior portions; while in other, but rarer, instances, it is seen only in the pyloric region or on the anterior wall, while the parts above mentioned have escaped. Often the softened portion is found to be abruptly limited by a well-defined border; but in other cases it merges insensibly into the surrounding membrane.

The softening and erosion often proceed to perforation of some parts of the stomach, intestines, or œsophagus,[1] allowing their contents to escape into the abdominal or pleural cavities, and in such cases analogous effects have been produced on contiguous viscera, especially on the spleen, liver, kidneys, or lungs; and in the last-named organs the change may be produced either subsequently to that of the diaphragm, or directly by perforation of the œsophagus, in the latter of which cases the alteration is usually found in the left side of the thorax.

The edges of the perforation of the stomach ensuing in this manner are thin, ragged, eroded, transparent, and having an appearance (to use the words of Hunter) "very much like that kind of solution which fleshy parts undergo when half digested in the living stomach, or when acted on by a caustic alkali."

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[1] De Caus. et Sed. Morborum, Epist. xxv. 2, xliii. 22, lv. 2.

[2] Phil. Trans. 1772, republished in Obs. on certain Parts of the Animal Economy.

[3] Expériences sur la Digestion, 1783, 264.

[4] On Poisons.

[5] Edin. Med. Surg. Journ. 1800, vol. vi.

[6] On the Vital Functions, 1817.

[7] Edin. Med. Surg. Journ. 1824.

[8] Edin. Med. Surg. Journ. 1830.

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[1] Wilkinson King, Guy's Hosp. Rep. vii. 1842.

Other authorities have, however, maintained that the forms of softening now described may occur during life as the result of disease. The chief of these have been Jaeger,[1] Camerer,[2] Cruveilhier,[3] Louis,[4] and Andral.[5] The three first named of these authors, and also Billard,[6] attributed to these supposed pathological conditions a definite set of symptoms, which are said to be met with in greatest frequency among children, but are stated to occur also occasionally among adults. Their leading characteristics are enumerated as violent fever, a semi-comatose condition, interrupted by restlessness, cries, and great irritability of temper, intense thirst, pain in the abdomen, frequent uncontrollable vomiting, diarrhœa, with grass-green stools, and early collapse, followed by death in a few hours, or in the course of a few days. It appears possible, however, from an observation of Ziemssen's, that under conditions involving the unduly long retention of the contents of the stomach in its interior in an acid condition, this effect may even be produced during life.[7]

There has been, however, a wide diversity of opinion among these authors respecting the nature of these changes, and every shade of appearance has been described as presenting a distinct pathological character, while the significance of each of these has, in almost every instance, received a different interpretation from those who have opposed the views of Hunter and Carswell.

Thus Jaeger and Camerer attributed them to disturbances in the nutrition of the stomach, induced by impaired innervation.[8] Andral, while recognizing as inflammatory the form of softening usually attributed to that process, described the appearances now under consideration as resulting from a vital change, non-inflammatory in its nature, and analogous to the softenings which occur in the cornea under conditions of impaired nutrition. Louis, on the other hand, regarded as inflammatory the softening which Carswell had ascribed to the action of the gastric juice; but described also a form of "simple softening," which he attributed to cadaveric change. Cruveilhier again distinguished two forms: the "Ramollissement pultacé" and the "Ramollissement gélatiniforme;" the former being, according to him, of post-mortem origin, while the latter is caused by a vital change, "specific" in its nature, and due neither to inflammation nor to gangrene, and to which he attributed the symptoms above described as characteristic of this variety.

Recent researches have, however, tended to confirm Hunter's opinion, and to show that the forms of softening described by Louis, Jaeger, Camerer, and Cruveilhier, and also the second form of Andral, are all to be ascribed to variations occurring in the same process of solution by the gastric juice. Cruveilhier's arguments against this view deserve, however, to be recapitulated, since they express most of the difficulties which have beset the adoption of this explanation of all the forms now under consideration; and it is chiefly to the elucidation of these that more modern observation has been directed. He stated that the theory of Hunter and Carswell was inapplicable to cases when the œsophagus, or the anterior wall of the stomach, was affected (the body having been placed after death in a recumbent posture); that the softening is sometimes found when the stomach was empty;[1] that it can only be artificially produced by a much larger amount of acid than is found *post mortem* in the stomach, and that the softening of the intestines, whose contents are normally alkaline, cannot be produced by the action of an acid.

In relation to these difficulties, it may, however, be stated—

(*a*) That, as shown by the observations

[1] Ueber die Erweichung des Magens: Hufeland's Journal für prakt. Heilkunde, 1811, 1813.

[2] Versuch. über die Natur der krankhaften Magen-Erweichung, 1828.

[3] Méd. Prat. éclairée par l'Anat. et Physiol. Path. 1821; Anat. Path. Liv. x.

[4] Du Ramollissement avec Amincissement de la Membrane Muqueuse Gastro-Intestinale, Rech. Anat. Path. 1826. De la Fièvre Typhoïde, 1841, 2d edit. pp. 156, 157, 407. Phthisis, Dr. Walshe's Trans. Syd. Soc. Ed. pp. 60, 189.

[5] Préc. Anat. Path. ii. 88; Clin. Méd. ii.

[6] Maladies des Enfants, 1828.

[7] See p. 130.

[8] An opinion still maintained by Rokitanski, Path. Anat. iii. 179. This distinguished pathologist states that precisely identical appearances may be produced in the stomach by changes ensuing before and after death. He says that the softenings of the stomach met with in cases of brain disease and in the acute febrile and inflammatory diseases, are effected during life in consequence of disturbed innervation. It would appear, however, to the author, for the reasons hereafter to be stated, that the post-mortem nature of these changes is the more tenable hypothesis, though the softening thus found may be due to and may indicate perverted conditions of secretion existing during life.

[1] For a confirmation of this statement see an experiment by Dr. Blandell, quoted by Dr. Hodgkin, Morbid Anatomy of Mucous and Serous Membranes, ii. 309: where a dog which had been maintained for weeks without food, by means of the injection of blood into his veins, was nevertheless found to have softening of the stomach after death.

of Dr. Gairdner, which have been confirmed by numerous subsequent observers, both forms of softening described by Cruveilhier have been found *post mortem*, unpreceded by any of the symptoms described by him and Camerer and Jaeger as characteristic of the supposed disease.

(*b*) The appearances thus described can be artificially produced at will after death in a previously healthy stomach in any part which is most dependent.[1]

(*c*) The observations of Brücke[2] and Bernard[3] have shown that for some time after death a substance continues to be formed in the gastric follicles, having all the properties of the gastric juice; and that the acid reaction, which during life is normally only found upon the surface of the mucous membrane, may within a few hours after death extend through its whole thickness. As also the gastric juice is normally formed in greater quantities in the cardiac than in the pyloric half of the stomach, the observations of Dr. Wilkinson King[4] concerning the greater acidity of this part when the stomach has been found so softened receive a further confirmation.

(*d*) Elsaesser's[5] observations further show that fermentescible substances, whether milk or those belonging to the amylaceous series, undergo, not only during life but also after death, an acid fermentation, and become capable of producing the phenomena of softening, both simple and gelatiform, not only in the stomach, but also in the intestines; and that when these changes have occurred in the latter organs, their contents have been found to present an acid reaction.

These fermentative processes may originate in imperfect digestion, to which infants are so liable. They are, however, most easily excited through the catalytic effects of the mucus produced by catarrhal inflammation. When present, they also tend to cause the acuter forms of gastro-intestinal catarrh, the symptoms of which correspond very closely with the disorders which have been described as symptomatic of these changes in the mucous membrane, but which are really only the consequences of the inflammation thus set up. The softening, on the other hand, is on this hypothesis believed not to occur during life, but to be the result of post-mortem action of the acids thus generated upon the coats of the stomach.[6]

(*e*) It remains to be shown why the condition is present in some cases and not in others; and perhaps among the most important of the former class must be reckoned those cases in which the membrane has been found softened, while the stomach is empty, as has been observed by Blundell, Cruveilhier, and Dr. Budd.[1] It is to elucidate these cases that Brücke's and Bernard's observations before quoted give the most satisfactory clue; and to these must be added the possibility brought forward both by Dr. Budd and Virchow,[2] that in many other diseases there is a tendency to a perverted secretion of the stomach, which probably exercises a peculiarly corrosive influence after death; though, as Virchow[3] has remarked (and his observations are supported by Camerer), the most irritating secretions formed during life appear to have no influence in producing this effect so long as vitality persists.[4]

(*f*) The frequent absence of these softenings has been fully explained by Drs. Budd[5] and Pavy[6] to be due to the alkaline reaction of the blood, neutralizing the acidity of the gastric juice, and also to the proportion borne between the amount of this fluid in the vessels and the acid reaction of the contents of the stomach. Immunity of the posterior wall, while the anterior portion has been affected, has further been explained by the former author to depend on the gravitation of the blood to this part of the stomach; or, as in a case reported by Burns, on the presence of an alkaline dropsical fluid in the cavity of the abdomen.

(*g*) The process of softening appears to be only slightly influenced by external temperature[7] — a fact explicable by the observations of Nasse[8] and Elsaesser,[9] that the cooling of the internal organs of the body is not so rapid during the colder seasons as might *à priori* be supposed; and their temperature often remains sufficiently elevated during a period adequate for the production, by self-digestion, of the appearances described.

(*h*) Lastly, when food is contained in

[1] Burns, Carswell, Camerer; also Williamson, Dublin Journal, vol. xix. 1841.

[2] Sitzbericht der Akad. der Wiss. zu Wien, xxxvii. 165.

[3] Liq. de l'Organisme, ii. 377.

[4] Guy's Hosp. Rep. 1842, vol. vii., and 2d Ser. vols. i., iv.

[5] Die Magen-Erweichung der Säuglinge, 1846.

[6] See, in support of this view, Virchow, Würzburg Verhandl. i. 296; Archiv. Path. Anat. v. 359.

[1] A remarkable instance of this kind is given by Dr. Budd, On the Stomach, 1855, pp. 16, 17.

[2] Würzburg Verhandl. loc. cit.

[3] Archiv, vol. v. p. 360.

[4] It now, however, appears to be probable that this may occasionally occur. See Ulcer, Etiology, also p. 130.

[5] Croonian Lectures, Medical Gazette, 1847; and Diseases of Stomach, 1855.

[6] Phil. Trans. 1863. Treatise on Digestion, 1867.

[7] Elsaesser, loc. cit. 51.

[8] Untersuch. zur Phys. Path. 1835.

[9] Loc. cit. p. 69.

the stomach, the effects of the fluid chyme on its coats may be influenced both by the amount and by the nature of the food. It has been long known that the gastric juice is only sufficient for the digestion of a certain amount of food,[1] and, therefore, if this be in excess of the powers of the solvent, its action cannot be exerted on the containing organ; while, on the other hand, as pointed out by Dr. Brinton,[2] amylaceous matters, which neutralize less of the gastric juice than albuminoid materials, tend, not only directly by their fermentation (to which allusion has already been made), but also indirectly by exciting the secretion of an acid fluid, to give rise to this solvent action. Further, as has been stated by Dr. Budd, medicinal substances, and especially alcohol, given shortly before death, may in many cases more or less completely prevent this chemical dissolution.

From the considerations above quoted, it therefore appears that in almost all cases, with the exception of the rare instance before quoted, the changes in the stomach now described must be regarded as the result of post-mortem effects of a purely chemical nature; but that, in a certain number of instances, morbid conditions of the stomach, which tend either to cause an increased secretion of the gastric juice, or to set up fermentative changes in the food (especially when this consists of milk or amylaceous substances), may favor this action. It is, however, one that only very rarely occurs to any appreciable extent until after life has ceased to exist, and the appearances so produced cannot therefore in the majority of cases be regarded as anatomical or pathological conditions to which any of the symptoms occurring during life can, with justice, be attributed.

It seems tolerably certain that these softenings are not identical with those produced by putrefactive changes in other tissues of the body, though these undoubtedly aid in increasing the degree of softness of the membrane. It is not indeed, in all circumstances, easy to discriminate the exact share attributable severally to each of these processes—which must be, to some degree, determined by the amount of cadaveric change observed in other parts. One of the most marked evidences of the latter, though not, comparatively, very frequent, is an emphysematous condition of the coats, arising from the development of gas through putrefaction in the submucous tissue.

It has been already stated that the imbibition of the mucous membrane with hæmatin may occur very early after death, and is due probably to both causes acting conjointly; but the blackened appearance of the blood in the vessels, though partly due to the action of the gases of the gastro-intestinal canal, is, in a great measure, the result of the action of the gastric juice, as has also been explained in previous sections.

[1] For further and exact confirmation of this fact, see Brücke, Sitzber. Wiener Akad. 1859.

[2] Diseases of the Stomach, p. 80.

XIII.—Perforation of the Stomach.

Perforation from within, formerly described as an independent disease, has received no recent trustworthy confirmation. The cases in which it has been described are now almost universally admitted to have resulted from ulcerative processes, or to have arisen from post-mortem softening. The modes of distinguishing these conditions have been already described (see Ulcer). Cases of perforation, due to foreign bodies in its interior, are, however, occasionally met with.[1] An interesting case of perforation of the stomach, caused by an abscess of the liver, which communicated simultaneously with the pericardium, is recorded by Dr. Graves.[2]

XIV.—Rupture of the Stomach.

Rupture has only with the exception of the rarest instances been authentically established in cases of external injury. Ziemssen has, however, seen rupture follow distension through fermentation processes in a stomach which was the seat of stricture arising from the healing of a chronic ulcer.[3] The symptoms have been those of collapse, followed by peritonitis.[4] The occurrence is most likely to happen when the stomach is distended by food at the time of the injury. Whether a fatty degeneration of the muscular coat of the organ may occasion the spontaneous oc-

[1] See a case by Drs. Quain and Bucknill, of perforation of the stomach by a mass of cocoa fibre, swallowed by a lunatic, Path. Soc. Trans. vol. v. Another, of perforation of the duodenum in a lunatic who swallowed spoon-handles and nails, has been recorded by Mr. Poland, quoted by Mr. Pollock, Holmes' Syst. Surg. ii. 470.

[2] Clin. Méd. ii. 236

[3] Sammlung clinischer Vorträge (Volkmann), No. xv. p. 100.

[4] A case of this kind occurring after a fall is recorded by Mr. Moore, Lond. Med. Rev. July, 1860. A case is also given by Richerand, Physiol. i. 282, of a woman in whom, after an external injury, a fistula subsequently formed, quoted by Dr. Pollock, Holmes' Surgery, ii.

currence of this event must remain a subject for further inquiry.

XV.—Tubercle of the Stomach.

This must be regarded as an exceptionally rare disease. Andral[1] says that he only met with it twice. Willigk[2] only found it five times in 1317 cases. In 141 cases of tubercle in the gastro-intestinal canal, Barthez and Rilliet[3] found the stomach affected in 21. These authors state that its seat is ordinarily in the great curvature, and that in this situation it may sometimes give rise to extensive ulcerations, which may attain the diameter of a five-franc piece.[4]

The author has never seen this disease commencing in the mucous membrane, but he has found a perforation of the stomach caused by tubercles commencing in the peritoneum, passing from without inwards through its coats, and thus following the tendency, observed by Barthez and Rilliet,[1] of tubercles seated on the peritoneal surface of other parts of the canal.

It may possibly be questioned whether the follicular ulcerations of the stomach, so common in phthisis, may not be due to the solitary glands undergoing changes similar to those seen in other portions of the intestine, but the author has not been able to obtain any positive proof of the identity of the process in these parts.

Perforation of the stomach by a tubercular ulcer, commencing in the submucous tissue of the great curvature, and attended by copious hæmatemesis, resulting from the invasion of the gastro-epiploic artery, has been recorded by Bignon.[2] Tubercles existed around this ulceration.

In the majority of cases recorded, no symptoms have been observed. In three only of the cases recorded by Barthez and Rilliet was vomiting present. The disease, in the present state of our knowledge, offers no distinctive features for either diagnosis or treatment.

[1] Prec. Path. Anat. ii. 178.
[2] Prager Viertel-Jahresch. vol. i. p. 80.
[3] Malad. des Enfants, iii. 183.
[4] See also Weissbach, Canstatt's Jahresb. 1844, iv. 203. Also Valentin, Virchow's Archiv, xliv. p. 306. The latter author distinctly traced tubercular ulceration in the stomach associated with granulations. He questions whether the granulations of tubercle were not secondary to the ulcer of the stomach. Steiner and Neurethe (Prager Viertel-Jahresch. 1865, ii.) have also seen this. I have seen the stomach perforated by tubercle, proceeding apparently from the peritoneum.

[1] Loc. cit. 780.
[2] Gaz. des Hôpitaux, 1853, p. 111.

B. DISEASES OF THE MOUTH.

By Charles E. Squarey, M.B. Lond.

1. Hemorrhage.
2. Stomatitis simplex.
3. Thrush.
4. Ulcerative Stomatitis.
5. Aphthous Stomatitis.
6. Gangrenous Stomatitis.
7. Glossitis.
8. Ulceration of the Tongue.
9. Salivation.
10. Maladies of Dentition.

1. Hemorrhage from the Mouth.

The mucous membrane of the mouth is much less liable to hemorrhage than is that of the nostrils; the most frequent seat of hemorrhage is the gums.

When not profuse, the symptom complained of is a continual spitting of blood; if profuse, it may run from the mouth in a stream, or it may be swallowed, and cause vomiting with symptoms resembling hemorrhage from the stomach; this occurs more frequently in children than in adults. Again, hemorrhage, coming from the back part of the mouth, may trickle down into the larynx and cause irritation and cough, with expectoration of blood, resembling pulmonary disease.

The diagnosis is, however, generally very easy immediately that attention is directed to the mouth, when the bleeding point may be at once detected.

If the hemorrhage be too profuse for the mouth to be inspected, the patient's head should be held forward to allow the blood to run out; and if it does so without coughing or vomiting, and if it is of a bright red color, neither, frothy nor grumous, there can be no hesitation as to its having its origin in some part of the mouth or pharynx. If the bleeding is not very profuse, and no bleeding point can be seen, if the patient feels a tickling sensation in his throat before he expectorates, or if he has a constant disposition to deglutition, and has no difficulty in hawking up the bloody sputa, it may be inferred that the blood proceeds from some part of the fauces; and in such cases, on inspection, the pharynx will be seen to be more or less congested, and the vessels to be full and very distinct. Again, when hemorrhage comes from this part, the use of a slightly astringent gargle, and even the mere act of swallowing solids, will generally cause a sense of discomfort if not of actual pain.

The spitting of blood is almost always referred by patients to the lungs, and in some cases it is difficult at first to decide whether it does come from the chest or not. Amongst the most puzzling are those cases where the patient every morning coughs up a little blood; more or less bleeding has taken place during sleep, and has collected about the pharynx and larynx, and in the morning on clearing his throat, he hawks or coughs up this blood.

The inspection of the pharynx, the history, and the absence of all pectoral symptoms will at any rate, in a short time, if not at once, reveal its true origin. The appearance of the blood, too, will also aid in the diagnosis. Usually, when expectorated from the lungs, it is liquid, florid, and more or less frothy, owing to its admixture with air in the respiratory passages. When from the mouth, it is only very slightly frothy from the admixture with the saliva, and more frequently, especially in those cases when it is hawked up every morning, it consists almost entirely of little coagulated masses of blood in a clear saliva.

In all difficult cases the patient should be made to rinse his mouth out with lukewarm water before inspection.

The Causes of this affection are those of hemorrhages generally, such as plethora, the hemorrhagic diathesis, scurvy, purpura, and the like. The local causes are violence, blows of any kind, biting

the tongue, an epileptic fit, extraction of teeth, the presence of inflammation or of ulceration. Wood records a case of very serious hemorrhage from the lancing of a vascular tumor of the palate in mistake for an abscess.

When the "hemorrhagic diathesis" is present, most serious losses of blood may take place, and in the worst of these cases it oozes from all points of the gums and palate. In such conditions the smallest wound or the least blow is sufficient to give rise to the most serious hemorrhage.

When bleeding from the mouth is vicarious, taking the place of hemorrhoidal or catamenial discharge, it is generally periodical; and when it occurs from inflammation or ulceration, as in the mercurial sore mouth, the hemorrhage may come from the surface of an ulcer, but more usually it is from the general surface of the mucous membrane.

In many cases of serious bleeding from the mouth, Frank has observed the veins of the part to be in a varicose condition; Vogel has also noted this condition, and has given to it the name of "Hæmorrhoides Oris."

The Prognosis depends entirely on the constitutional condition of the patient, the quantity of blood lost, and the effects that its loss may have produced.

Treatment must be guided by the cause. If the hemorrhage be simply due to violence, the patient should be given ice to suck; and should use astringent washes or powders, such as alum, kino, catechu, and tannic acid; with pressure if necessary. [Hot water (115° to 120°) has lately been used with good effect.—H.] If the hemorrhage be due to a general constitutional disease, remedies to correct that condition should be administered; but if it takes place vicariously of natural discharges, efforts should be made to restore those functions which have been impaired.

Different forms of Inflammation of the Mucous Membrane of the Mouth.

The form assumed by Inflammation of the Mucous Membrane of the Mouth depends partly on the nature of its cause, and partly on the constitutional condition of the patient.

Inflammation is much more frequent in children than in adults, and it may be either a primary, or a secondary or sympathetic, affection.

2. Stomatitis simplex.

This is known also as Simple Erythema of the Mouth, or Common Diffuse Inflammation of the Mouth.

It is a slight and badly-defined disease, lasting rarely more than a few days if properly treated, and causing very slight constitutional symptoms. It may, however, end in ulceration if not attended to. It is most common in infants between two months and one year old, and seems to be due entirely to bad feeding and bad hygienic conditions. It is thus much more frequent amongst the children of the poor, especially in those brought up by hand, than in those of the upper classes. It is, however, sometimes the result of sore or inflamed nipples of the nurse.

The symptoms first drawing attention to the disease are the general restlessness and peevishness of the child, loss of appetite, dryness of the mouth, and now and then some slight diarrhœa, with more or less distension of the abdomen.

On looking into the mouth, the mucous membrane is seen in places to be redder than natural, raised above the general surface, and presenting a dryish, glistening appearance.

These patches are generally to be seen on the inside of the cheek, about the level of the line of junction of the gums, and round about the angles of the mouth; they are irregular in shape and size; the larger patches are formed by the junction of the smaller ones, and by their thus joining together they may extend so as to cover the whole of the mucous membrane of the mouth, and even of the palate and the gums. Such extensive inflammation is, however, exceedingly rare. The centres of these patches have a yellowish tinge, their margins are bright red, and there may be even some slight effusion of lymph, forming a soft membrane on the surface.

Simple Stomatitis easily gives way to simple remedies, such as a dose of castor-oil and the regulation of the diet; but if attended with gastric irritation—to which it frequently is secondary—small doses of magnesia, or of rhubarb and soda, should be given. If the child is being brought up by hand, the addition of lime-water to its milk, in the proportion of one part of lime-water to two parts of milk, will be of service.

The mouth should always after every meal be washed out by dipping a soft rag in lukewarm water and gently rubbing it over the internal surface of the mouth.

When due to hot or acrid substances taken into the mouth, mucilaginous drinks should be given; if due to teething, the gums, if necessary, should be lanced.

3. Thrush.

Thrush—known also as Diffuse Inflammation of the Mouth with Curdy Exudation, as White Mouth, or Le Muguet

—is a form of inflammation of the mouth met with at all ages, but much more frequently in new-born infants and children than in adults. It occurs usually as a complication of other diseases.

In new-born infants it is, however, so easily produced that it has been called in them *idiopathic;* but as it is invariably preceded by some gastric symptoms, and more or less diarrhœa, it is in infants, as in adults, a secondary affection. The change in the secretion of the mouth from an alkaline to an acid reaction is favorable to the production of this disease; and as during the first weeks of infancy the mucous membrane of the mouth yields, even in a state of health—and wholly independently of whether or no the child is brought up at the breast—an acid reaction, this circumstance accounts for the far greater liability of infants than of adults to this affection. (West.)

The invasion of this disease is generally marked by more or less constitutional disturbance; the symptoms first noticed by the mother being slight feverishness, irritability, loss of appetite, and the presence of a little diarrhœa: severe diarrhœa is not by any means a constant primary symptom. The mouth is generally hot and dry, and the secretion of the saliva lessened.

On looking into the mouth, if the child be seen before the characteristic white curdy exudation has made its appearance, the mucous membrane is found in places to present the same appearance as that described in Simple Erythema. Small red raised patches are to be seen. They may appear first either on the tongue, the insides of the cheeks, or at the inner margin of the lips, at the angles of the mouth, and generally at this latter part first. In this stage it cannot be diagnosed from simple erythema, the heat and dryness of the mouth and the red raised patches being similar in both; but it is rare in this disease for the child to be brought under notice so early that some of the characteristic curdy exudation is not to be seen on some part of the mouth. The time that elapses between the first symptom of the disease and the appearance of the curdy exudation has not been determined. Wood says two or three days, or even less.

This curdy exudation commences in these inflamed patches in isolated points, which approach each other gradually, and in certain cases form a membrane altogether continuous. When this happens, the inflammation is very intense. There is scarcely any part of the mouth anterior to the palatine arch which may not be covered with this perfectly continuous false membranous product; and it offers a surface as if covered with a croupy or diphtheritic exudation; hence the use of the term Diphtheria of the Mouth, which by some authors has been applied to this affection, a name which, from the severity of the disease to which it refers, should, I think, never be used for an affection such as Thrush, as it is undoubtedly liable to cause much anxiety amongst the friends of the little patient.

From whatever cause produced, the false membrane is generally seen in patches, altogether or partially isolated, and thickest on the inner sides of the cheeks and mouth, where they could be easily confounded with curds of milk, so much do they resemble them. On the tongue, the roof of the mouth, the pharynx, and in the œsophagus, the patches of false membrane are more irregular in shape and size.

At first this exudation is rather firmly adherent, and cannot be raised without causing slight bleeding; but, after a few days, it becomes loose, falls off, and is replaced by fresh exudation. Its color is usually white; sometimes it assumes a yellowish or brownish color; the latter is considered an unfavorable sign.

The mouth of the infant is hot, and frequently the nipple of the nurse is more or less excoriated.

More or less diarrhœa is generally present; the stools are fetid, and of a greenish-yellow color; sometimes white curdy masses are passed with the stools—and this is considered evidence of the disease having extended to the bowels, though I am not aware that this has been proved by the microscopic discovery in these masses of the cryptogamic growth peculiar to the exudation in the mouth. In two or three cases in which I examined these white masses, no trace of it was to be seen; the masses seemed to consist entirely of curdled milk.

Redness around the anus and on the buttocks is not uncommon, and is probably due to the acrid discharges. Valleix, however, states that he has found Thrush commencing with erythema of the buttocks, rapidly followed by diarrhœa, and swelling with redness of the papillæ of the tongue, which, a few days after the occurrence of the first symptoms, were covered with the characteristic exudation.

The affection may be so slight as to be considered entirely local (idiopathic), but in by far the greater number of cases there is some acceleration of the pulse and febrile heat.

As it usually occurs the disease is without danger; but in weakly, scrofulous children, when secondary to gastric and intestinal disease, it often proves fatal: but in these cases death is caused by the general condition, of which Thrush is merely the local expression, and not by the Thrush itself.

The duration of Thrush is uncertain, sometimes lasting only for three or four days, at other times becoming chronic, and lasting for several weeks; it often returns after apparent cure, and this may happen repeatedly during a period of several months.

Its appearance in the course of acute and chronic diseases is a sign of grave importance, especially in the latter, it invariably in these cases foretelling a not far-off-fatal termination.

In the acute specific diseases, and other acute attacks, although its appearance bodes no good, yet, as I have frequently heard Sir William Jenner say, it is not nearly of such grave import as in chronic cases, and I think I am not wrong in stating that in these acute diseases it does not interfere with recovery.

It may occur in all diseases which undermine the general constitution, especially those in which the alimentary canal is affected. Anæmia in delicate girls is, in rare cases, sufficient to cause it, as in the case of a girl, aged 19, under my care last year.

The peculiar exudation of Thrush has been seen to extend from the mouth down the œsophagus to the stomach: its appearance in the stomach is, however, rare. Valleix states once in twenty-two cases. It has also been seen in the small intestine, where it covered one of Peyer's patches, and once in the large intestine, in the cæcum.

Under the microscope, the curdy exudation of Thrush has been found to consist of thickened epithelium cells, mingled with numerous minute cryptogamic sporules or seeds, from the midst of clusters of which long, thread-like, jointed, and branching plants arise intertwining with one another. It was discovered by Berg of Stockholm, and Grubz of Vienna, at the same time, and has been named the Oidium albicans.

Etiology.—It has been, I believe, now undoubtedly proved by Berg, that this plant is the origin of the disease; the sporules, floating about in the respired air, attach themselves to the mucous surface and, under favorable circumstances, become developed and propagate.

These circumstances may consist in some previous morbid state, changing the buccal secretion from its normal alkaline character to that of acidity, which probably favors the growth of this as of other microscopic fungi.

The complaint is contagious, as proved by Berg, who in four instances, by transplanting the plant from a diseased to a healthy child, succeeded in propagating the disease.

Of the predisposing causes, it may be said generally, that whatever tends to impair the vital powers of the child predisposes to this affection: thus it is found chiefly amongst the children of the poor, whose surroundings in large towns are generally anything but healthy.

It is especially noticed in children brought up by hand, in children prematurely born, and in those nursed by unhealthy mothers. Inflamed and irritated nipples will also produce it.

Boerhave says in some cases it is due to protracted suckling; and this, perhaps, explains its presence sometimes in children well fed, and brought up, apparently, in the most favorable circumstances.

Barthez and Rilliet think that in some mild cases, in which they have met with it in children of primiparous women, it has been due to the fatiguing effort of suckling owing to the nipples of the breast being little formed. Dr. Strœblin, of Geneva, has also noted this cause.

Treatment. — In mild cases, when there is not much constitutional disturbance, very little is required beyond local applications. A dose of castor-oil to free the stomach and intestines from any irritating matters that may be present, a careful regulation of the diet, and the local application of a little borax, either dissolved in honey, or in the form of powders, mixed with sugar in equal parts, is all that is necessary.

If the child is badly nourished, and the attack is attended with vomiting and purging, the treatment may with good effect be still commenced with castor-oil. If the purging still continues, magnesia and chalk, with a little opium, should be given occasionally.

If the child is being brought up by hand, lime-water should be added to its milk in the proportion of one part to three of milk; if at the breast, the nurse should be examined to see that she is quite healthy, that the nipples are not excoriated or inflamed in any way, that the milk is good, and that there is plenty of it; and she should be advised to give up all acescent foods.

The child's mouth should be washed out after every meal, as directed in Simple Erythema.

Cod-liver oil in doses of ʒss, three times a day, may also be given, and if retained, it does much good. In severe cases, if the breath be fetid, and if there be much swelling of the lips and gums, chlorate of potash should be given freely in doses of from three to five grains dissolved in a tablespoonful of water, every four hours; and in cases inclined to be chronic this makes a very good wash for the mouth.

Creosote,[1] vinegar, and alcohol have been recommended as local applications.

[1] Creosote will require considerable dilution as an application to sore mouths in children.—H.]

A solution of sulphate of zinc, two grains or more to the ounce, may also be used in chronic cases.

Sir W. Jenner recommends a solution of sulphite of soda, in the proportion of ʒj to the fʒj, and ascribes its beneficial effect to the destructive influence of the sulphurous acid on the parasitic fungus.

Whatever washes may be used, the application should be made from four to five times a day, and care should be taken not to irritate the inflamed parts by rubbing them more than is necessary.

In adults the same applications may be made. Dr. Tanner recommends a solution of bromide of soda, ʒj to the fʒj, with a little glycerine. The mouth should be frequently rinsed with this.

4. Ulcerative Stomatitis.

In the two previous diseases of the mouth no ulceration or loss of substance occurs; but the disease we are now about to consider is characterized by the formation of thick, adherent, yellow patches of membrane, and by inflammation, erosion, and ulceration of the subjacent parts. Cancrum oris has by some authors been described under this head, but in this work it will be treated as a distinct disease, inasmuch as it differs entirely in the character of its ulcer.

The membranous form of this disease is most probably the early stage of the ulcerative affection; it may not, however, proceed so far as ulceration, the thickened patch of membrane being either absorbed or thrown off without the formation of an ulcer.

The patches of membrane are at first white; they then become gray, and sometimes almost black; the mucous membrane around them is red, swollen, and inflamed; the false membrane looks as if imbedded in it; it is firmly adherent at first, and, if raised at this time, is found to have covered a superficially eroded, bleeding surface.

If it proceeds to ulceration, the membrane comes off, and discloses an ulcer with irregular red or violet-colored margins, and generally covered with more or less of a thick, yellowish, pultaceous exudation.

The onset of the disease is not marked by any special symptoms, and it is rare for the child to be brought under notice till more or less ulceration exists.

On opening the mouth, irregularly-shaped, isolated patches of ulceration are to be seen on the inner sides of the cheeks opposite to the line of junction of the teeth, and extending down from this below the angle of the mouth to the gums of the incisor and canine teeth; the gums are swollen and spongy, and bleed easily; later on they become retracted, the teeth are laid bare, and become loose.

The ulcers, at first more or less isolated, soon run together, and form a line as above described, with irregular, grayish, and raised edges, the membrane around being swollen and inflamed, and of a bright red color. The inflammation may spread rapidly, and involve the whole mucous membrane of the mouth, and even of the palate; but such severe cases as these are exceedingly rare. At first the ulcers are quite superficial, but if left to themselves they become deeper, and the disease gets into a chronic state which is sometimes very difficult to cure.

For some time after the ulcers have healed there is more or less redness of the new-formed membrane, and the subjacent tissue remains hard and thickened.

Accompanying the ulceration there is more or less swelling of the side of the face attacked; and the neighboring glands, sublingual and submaxillary, become hard, painful, and very tender to the touch. The surrounding cellular tissue very rarely participates in this inflammation.

The breath in bad cases is generally intensely fetid, and the flow of saliva much increased.

The disease generally commences about the gums,—the lower ones more frequently than the upper,—and in by far the greater number of cases only one side of the face is attacked, the left side being the most frequently favored in this respect.

It is not a dangerous disease, thus differing greatly from cancrum oris, which is very fatal. It may be easily distinguished by the fact that, in this disease, the swelling of the face is neither hard, resisting, nor circumscribed, and the skin neither tense, shining, nor hot, symptoms which are always present in cases of cancrum oris. The characters of the ulcer are also very different. See Cancrum Oris, p. 139.

Duration.—If not treated it may last some months, and even under treatment, if the child be living under bad hygienic conditions, it is sometimes very troublesome to cure. It has a great tendency to recur.

Age.—It is most common between the ages of five and ten years; it may come on during weaning, and it is said to occur more frequently in boys than in girls, though my experience points entirely in the other direction. It is more common in autumn than at other times of the year.

Causes.—These may be local or constitutional. Thus, caries of a tooth, or

fracture or necrosis of the bones of the jaw, will produce it in weakly, scrofulous children; but it is essentially one of those diseases which result from want of proper care and nourishment, and is almost entirely confined to the children of the poor, who are badly looked after, badly lodged, and badly nourished, and living in low, damp, and deficiently ventilated houses.

The TREATMENT consists of constitutional and local remedies. The child should be removed, if possible, from the bad hygienic conditions under which it may have been placed, and tonics, as steel-wine and cod-liver oil, should be administered.

The secretions should be attended to, and kept regular and natural.

Of the topical applications, powdered alum, nitrate of silver, nitrate of mercury, and hydrochloric acid may be named, and of these alum, either used as a powder or in the form of a wash, will generally be found quite sufficient; but if the ulcers be slow to heal, their surface should every now and then be cauterized with nitrate of silver. Gargles of chlorate of potash, from five grains to one scruple to the ounce, or even stronger, may be used, other means failing; its internal administration also seems in some cases to have a very beneficial effect. [Given early, in five grain doses three times a day, it sometimes acts almost like a specific. Other good local applications are, a powder made of equal parts of prepared chalk and gum arabic; and prepared chalk mixed with glycerin.—H.] In one obstinate case I found brushing over the raw surface with a mixture of equal parts of the tincture of the sesquichloride of iron and glycerine to have a very good effect.

GINGIVITIS is an affection resembling ulcerative stomatitis, but differing from it in its seat. In this disease the gums alone are affected; they become swollen, spongy, bleeding, and ulcerated round the margins of the teeth: they retract from the teeth, and render them so loose that they may fall out.

It is common at the same ages as ulcerative stomatitis, and is produced and predisposed to by the same causes. The treatment is exactly the same.

5. APHTHOUS STOMATITIS, OR FOLLICULAR STOMATITIS.

The word Aphthæ, derived from the Greek ἅπτω, to inflame, was formerly applied to all the various inflammations of the mucous membrane of the mouth; but now it is used in a much more restricted sense, being applied only to all those small isolated ulcers so frequently seen on the mucous membrane of the mouth.

Follicular Stomatitis I have also placed with this disease, it being considered by some, and by Bellard especially, as the origin of all aphthæ.

Follicular inflammation may not go so far as to cause ulceration; the follicles then are seen to be inflamed independently of the surrounding mucous membrane. They appear as small, red, slightly elevated, round spots, hard and almost shotty to the touch, with, in the centre, a little black punctum, the opening of the follicle. If at this stage the inflammation does not subside, the hard central part softens and ulceration takes place: the ulcer being round, having sharply defined edges, surrounded by a small circle of inflammation. If many follicles are inflamed close together, the ulcers may join together, forming irregularly ulcerated patches.

The most frequent source of aphthæ, however, is a vesicular eruption, very much resembling herpes, which appears on any part of the mucous membrane of the mouth, and is not confined to the follicles.

In the first stage small vesicles are seen, containing in the beginning a clear limpid fluid, which soon, however, becomes whitish, surrounded by a slight circle of inflammation. The vesicle becomes distended, and finally ruptures, leaving in its place a small ulcer, with a grayish-yellow base, and having a bright red and sharply defined regular margin. The ulcer is often very painful, sometimes so much so as to cause the patient to refuse as much as possible all nourishment. The buccal secretions are always more or less increased, but abundant salivation is an exceptional symptom.

Generally about six or seven of these ulcers are to be seen on various parts of the mouth; it is very rare to find only one, and still rarer to find those that do exist running together and becoming confluent. I have never seen a case of confluent aphthæ.

The most frequent seat of these aphthous ulcers is the internal surface of the lower jaw, in the sinus, between the lips and the gums then on the sides of the tongue. They are occasionally to be seen on the tonsils and palate, but are less frequent in this position than elsewhere.

There is generally more or less inflammation of the gums, especially when the aphthæ are in the sinus, between the gum and the buccal wall.

Very little constitutional disturbance accompanies this disease when occurring in adults; it is almost entirely local, the pain and discomfort in the mouth produced by the ulcers being the only sign of

the disease. In these cases, when the medical man is called in, the disease has always existed for some few days, and has become thoroughly confirmed.

In severe cases in children there may be much fever, great difficulty in swallowing, great pain and swelling, and very fetid breath; but such cases as these are very rare: it is quite exceptional for the constitutional symptoms to have any marked importance.

Ordinarily the little patients are slightly feverish, restless, and irritable, with white tongues, no appetite, and some thirst. Under judicious treatment all these symptoms rapidly disappear, and the ulcer quickly heals.

The disease generally lasts about a week, sometimes longer, especially if successive eruptions come out. It is common to all ages, attacking equally children and adults. It is very liable to return.

Simple aphthæ do not constitute a dangerous disease; but the confluent variety may be accompanied with much constitutional disturbance, with vomiting, diarrhœa, &c., which show its propagation to other parts of the intestinal tube, and in this form it may prove fatal. It is very common in some countries, especially in Holland, and it attacks people in ill-health, women in childbed, and those badly nourished more frequently than others.

Cause.—No definite cause is known. It is observed to be more frequent in weakly children, and those subject to catarrhal and eruptive diseases. Unfavorable hygienic conditions predispose to it; and yet, again, it is occasionally observed in children placed in this respect in the most favorable conditions.

Barthez and Rilliet have had occasion to think that in some cases it must have been hereditary.

Treatment.—In by far the greater number of cases very little medicinal treatment is required. The patient should be placed in as favorable hygienic conditions as possible; the diet should be regulated, and should consist of easily digestible food; all irritating matter should be excluded. Wine, if the child be low, should be given in moderate quantities, and the secretions should be seen to be healthy in character, and normal in amount. [Chlorate of potassium may be given with probable advantage.—H.]

If purgatives are required, a small dose of rhubarb and soda, or, in an adult, a dose of calomel, should be given; and in rare cases, if there be swelling of the face, with much fever and a strong pulse, the application of two or three leeches will be found useful. Tonics, however, are much more frequently required than lowering measures.

The local treatment consists in the use of washes for the mouth—at first, whilst there is much inflammation—of a demulcent character, as linseed tea, mucilage, &c., followed, on the subsidence of the inflammation, by astringent washes, as solutions of alum, acetate of lead, sulphate of copper or zinc—and these should be painted on the ulcers with a camel's-hair brush.

Nitrate of silver applied in the solid form is also very effective.

6. Gangrenous Stomatitis.

Synonyms.—Gangrenous Inflammation of the Mouth; Gangræna Oris; Sloughing Phagedæna of the Mouth; Necrosis Infantilis.

This is by far the most serious of all inflammations of the mouth. Formerly it was considered as only an aggravated form of the ulcerative stomatitis previously described, but its peculiar characters and almost invariable fatality have induced all modern authors to describe it as a distinct disease.

Fortunately it is almost as rare as it is fatal. It invariably attacks either very delicate, badly nourished, scrofulous children, or those whose health has been previously much undermined by some severe disease, especially such diseases as are connected with important changes in the circulating fluid, as the acute specific fevers.

Symptoms.—The disease is very insidious in its origin, being accompanied with scarcely any pain in its early stages; and from this, and from the fact that the child is generally suffering from some other serious disease, or just convalescing from it, it may not be discovered till it has made some considerable progress.

There is some difference of opinion amongst authors with regard to its commencement. Barthez and Rilliet assert that it always begins by ulceration in the mucous membrane, whilst others, as Bellard and Richter, believe that it commences in the substance of the cheek by swelling and the formation of a central hard spot or nucleus of infiltrated and indurated fatty tissue, surrounded by a dense elastic, but less firm, swelling, passing off into the texture of the adjacent parts; and that the ulceration of the mucous membrane is secondary to this.

The first symptom of the disease which may attract notice may be either swelling of the cheek, fetor of breath, or profuse salivation.

It is noticed almost invariably by the mother or nurse first, the little patient

rarely being rendered sufficiently uncomfortable by it as to complain of it. Thus it is a complication which should always be thought of and looked out for in the convalescence of weakly children from severe diseases, especially when these occur between two and five years of age, this being the period at which cancrum oris is most common.

Swelling of the face is the symptom generally noticed first, and its character is so peculiar that it may be almost considered as pathognomonic of the disease.

The skin has the appearance of being tightly stretched over the swelling; it is red and shining, with a bright red spot in the centre, shading off gradually into the natural color of the cheek. It feels dense, hard, and distinctly circumscribed under the bright red central spot, and to the hand it is perceptibly hotter than the other side of the face. There is rarely much tenderness, if any, either on pressure, or movement of the jaws; the breath has invariably at this early period a distinctly gangrenous odor, and the secretion of saliva is greatly increased.

On examining the mucous membrane of the mouth, there is seen on some part of its internal surface, it may be either on the inner surface of the cheek, at the line of juncture of the teeth, or on the gums, or the sulcus between the gums and buccal wall—and Barthez and Rilliet have found the sulcus between the lower gum and the buccal wall the most frequent spot—a small ulcer of an irregular shape, with more or less jagged edges, and having a dirty brownish slough attached to it. The edges are at first a bright or livid red color, and bleed easily. The ulcer spreads very rapidly, and communicates the same condition to the parts which are in contact with it, so that from the gum it passes to the buccal wall and *vice versâ*. If in the sulcus, it spreads at once throughout its length, and upon both sides. The teeth, very quickly denuded of the gums and covered with putrefying matter, soon become loose, and may fall out, and further on in the disease necrosis of the maxillary bones takes place. Taupin affirms that he has even observed separation of the necrosed parts, but this is very rare, as death generally occurs too soon for them to be thrown off.

The saliva, very much increased, is fetid, and soon becomes discolored with the discharges from the ulcer.

Coincident with the extension of the ulceration in the mouth, changes take place in the external swelling; the bright red central spot, increasing somewhat in size, gradually becomes more and more livid, till at last in the centre it is quite black. At first very small, this black spot increases rapidly, till it occupies the whole portion of the cheek, covering the hard central nucleus; and then the process of separation commences; the slough is thrown off, if the child lives long enough, and the cavity of the mouth is laid open.

The slough generally makes its appearance between the third and seventh days of the disease. After its separation the ulceration still continues advancing into the remaining portion of the cheek, gradually eating it away, and producing the most horrible appearance, till at last death closes the scene.

With all this ulceration there is rarely much pain, and sometimes, as Dr. West says, the cheerfulness of the child is undisturbed, and it will sit up in bed playing with its toys till long after the appearance of the black eschar in the cheek has shown the case to be almost hopeless. But it is only rarely, and in mild cases, that so few constitutional symptoms are present. Generally, although not complaining of pain, the little patient is more or less prostrated, taking no notice of whatever may be going on, and having a great objection to be disturbed. Sometimes there is much drowsiness, the child almost continually sleeping. Much of this condition, however, may be due not so much to the disease itself as to the state to which the child had been reduced by its previous illness. Food and nourishment are invariably taken quite well, even up to a few hours before death.

The glands in the neighborhood are generally much swollen and hard, and there is much infiltration of the cellular tissue around.

After the separation of the slough, however, the child may recover. The ulceration then takes on a healthy form, granulations are thrown out on all sides, the swelling disappears, and the hole is gradually filled up, though always with more or less retraction of the cheek and deformity of the face. In some cases a small fistulous opening may remain; in other cases, if ulceration has been extensive on the contiguous surfaces of the cheek and gums, these may be united in the process of healing, causing great deformity, and diminishing very much the little patient's power of opening its mouth.

The pulse depends, like the rest of the constitutional symptoms, on the previous condition of the child. In some cases noted by Barthez and Rilliet, when the gangrene of the mouth was the principal symptom, it was never higher than 120, and gradually became slower and weaker as the disease progressed towards a fatal termination.

The amount of fever that is present has never, so far as I know, been determined by the thermometer. The side of the face attacked is invariably hotter than

the other; but the temperature of the body—in judging by the hand the cases that I have seen—is not at all elevated. The skin is generally more or less dry. There is rarely any sweating.

The tongue is moist throughout, with more or less of a dirty yellowish fur on the dorsum. The digestive system seems to be very slightly impaired in this disease, all nourishment being taken at first with avidity, and even at the end without any reluctance.

At the post-mortem examinations there are invariably found some small nodules of pneumonia scattered throughout the lungs. Lung symptoms are, however, not noticed during life.

Prognosis in this disease is always very grave; in a large majority of cases it terminates fatally. Of twenty-one cases under the care of Drs. Barthez and Rilliet, twenty died; of ten under the care of Dr. West, eight died; and of three cases that I saw whilst at the London Fever Hospital, two died.

Pathology.—Gangrene of the mouth invades all the tissues forming the buccal wall. The conditions of the skin, mucous membrane, teeth, and bones have been fully described amongst the symptoms of the disease. Of the intervening tissues, the fatty cellular tissue and the muscular tissue are found to be infiltrated with serosity, and certain parts, corresponding to the extent of the ulcer, mortify and are thrown off with the slough; the glands in the neighborhood, superficial and deep, are also indurated and infiltrated in the same way. On dissection, it is found that the vessels for some distance around are firmly plugged with coagulated blood; and this, therefore, is the reason that in this disease severe hemorrhage is never seen. The nerves, in one instance in which they were dissected by Barthez and Rilliet, were found to have the same appearance as the other tissues in the middle of the gangrene; but this was found not to have extended further than the neurilemma; the white substance of Schwann having quite a normal appearance.

With the exception of the lungs, other organs do not seem to be affected by this disease. In the lungs small nodules of pneumonia are invariably found, due either to the general blood condition, or, as I should think more probable, to the conveyance by the blood of small masses of putrid slough from the gangrenous ulcer to the lung.

Etiology.—Gangrene of the mouth, like all the diseases previously described, is predisposed to by all conditions tending to impair the general health of the patient; yet it is rare, and only in very weakly, badly nourished, and scrofulous children, that bad hygienic conditions are sufficient to produce this grave affection. In by far the majority of cases it follows some acute illness by which the health of the child has been greatly undermined. The disease of all others which seems more especially to predispose to this affection is measles. Of ninety-eight cases collected by M. Tourdis, in forty-one, or nearly half the cases, it followed measles. In nine it followed intermittent fever; in nine typhoid; in seven it is put down as due to calomel; in six it followed pertussis; in five, scarlet fever; in five, enteritis; and the remaining cases followed various diseases.

Again, of forty-six cases, collected by MM. Boulez and Cailhault, in thirty-eight it followed attacks of measles.

It is most common between the ages of two and five, but may occur at any age between one and twelve years.

Treatment is both local and constitutional; but the local is much the more important, and must be carried out thoroughly and energetically from the first moment that the disease has been discovered.

It consists in the application to the ulcer of strong hydrochloric or nitric acid; the latter is most frequently used. A small piece of lint should be tied round the end of a stick of convenient size, and this dipped in the acid should be applied most thoroughly to all the ulcerated part. Care should be taken not to touch more than possible the healthy tissues around, and the tongue can be kept out of the way with a spatula, but every part of the ulcer must be thoroughly mopped out. And this must be done directly the disease is discovered, for the ulcer advances so rapidly that the delay of a day, or even of a few hours, seriously lessens the little patient's chances of recovery. The mouth should then be thoroughly washed out with water mixed with Condy's fluid or solution of chlorine or carbolic acid; and a piece of lint soaked in the solution used should be kept constantly applied to the ulcerated surface: this dressing should be changed at least every four hours, and at every change the parts should be most thoroughly washed.

[Another good lotion is, a solution of creosote in glycerin; two drops in the fluidounce.—H.]

One thorough application of the strong acid may be sufficient. If the ulcer continues to look dirty when examined the next day, and shows any signs of spreading, it should be again mopped out. If this application be made early in the disease, the patient has some chance of recovery, but otherwise the case is almost

hopeless. A linseed meal poultice should be applied to the outside of the cheek.

The constitutional treatment consists in supporting the little patient with tonics, good nourishment, and stimulants. Chlorate of potass may be given in doses of five to ten grains every four hours. Dr. Burrows has treated cases of this disease successfully by this remedy alone, without any other local application than a chloride of soda gargle; yet I should be sorry to trust to this medicine alone, even in very mild cases, and should not hesitate for a moment in any case about applying the strong acid. The secretions should be attended to; and if purgatives are required, castor-oil should be given. Mercury in any form should not be administered.

During the whole progress of the disease the ulcer must be daily examined; one must not be satisfied with the general appearance of the patient, as this is often most deceptive. Whatever prognosis be given, it should be regulated much more by the state of the ulcer than by the general symptoms.

7. Glossitis—Simple Inflammation of the Tongue.

The various inflammations of the mucous membrane of the tongue have been described in the preceding sections with those of the mucous membrane of the mouth.

The disease now to be spoken of is an inflammation of the substance of the tongue, a very rare disease, sometimes caused by direct injury, by contact with irritative or corrosive substances, by scalding drinks, and by the bites or stings of insects.

Occasionally, it arises in the course of, or during the convalescence from, some one of the exanthematous fevers. I have known it to occur, without apparent cause, after an attack of typhus fever, in a boy aged 17, seemingly strong and healthy.

Wood says it may be produced by a direct propagation of inflammation from the tonsils.

It is, however, far more frequently due to the action of such medicines as mercury than to any other cause, and these cases will be further spoken of in treating of salivation.

The symptoms of the disease are swelling, tenderness, and increased redness in the inflamed organ; the whole tongue becomes enlarged. Generally commencing at the tip, which becomes bright red in color, tense, shining, and painful, it in a few hours may extend backwards throughout the whole substance of the tongue, and cause it to enlarge so much as to fill the whole mouth, and even to protrude from it.

The floor of the mouth may be pushed down, the soft palate elevated, and the epiglottis so much pressed upon as seriously to impede respiration, and render suffocation possible. In such severe cases as these, the power of articulation is completely lost, and deglutition is rendered exceedingly difficult.

The breath becomes very fetid, and altogether the patient is reduced to the most distressing condition. There is always some constitutional disturbance; the pulse is quick, hard, and bounding; the temperature is raised; there is a complete loss of appetite, and much thirst. The inflammation may extend to the surrounding parts; the sublingual and submaxillary glands can be felt enlarged, hard, and tender under the jaw.

Under treatment the inflammation invariably terminates in resolution, but if neglected suppuration or gangrene may occur. After an attack of glossitis the tongue may remain permanently enlarged, so as to protrude beyond the teeth, requiring, other means failing, the removal of a portion of it.

Treatment is very simple and efficient. Free incisions should be at once made into the inflamed part of each side of the raphé, so as to allow the free escape of blood and serum, and in a few hours this will be found to have reduced the swelling immensely.

Saline purgatives should then be administered, and the patient, if otherwise well, should be kept on a low and farinaceous diet for a few days; and this treatment, followed by a course of tonics, will be all that is required for the patient's thorough restoration to health.

If, however, permanent enlargement of the tongue results from one of these attacks, before resorting to operation, Dr. Druitt recommends that gentle pressure should be applied to the enlarged and protruded part. In a case of the kind under his notice, he found that the continuance of the protrusion was owing, first to the impaired function of the recently-inflamed organ, and secondly to some amount of constriction by the teeth. In this case, the application of gentle pressure was completely successful.

8. Ulceration of the Tongue.

Of various forms of ulcer, those due to aphthæ have been noticed under the head of Aphthous Stomatitis.

A second set of ulcers are due to the irritation of decayed teeth in a constitution otherwise impaired. They occur generally at the sides of the tongue, opposite the molar or canine teeth. They are

not at all indurated, and the edges are generally pallid and free from all signs of inflammation. They are easily got rid of by the abstraction of the offending tooth, and the use of astringent applications, nitrate of silver, sulphate of copper, &c., and a course of tonic treatment.

A third set of ulcers are due to syphilis. They are to be recognized by being elongated and irregular in shape, with glazed surface and indurated base, and by having swollen and indurated margins protruding above the level of the ulcer. They are not so tender, as a rule, as other ulcers, and they are sometimes very difficult to cure. Their diagnosis is, of course, helped by the history of the case, and the presence of the signs of syphilis on other parts of the body.

It is important to be able to diagnose these syphilitic ulcers from cases of cancer; it is sometimes exceedingly difficult, and can only be cleared up by time. The syphilitic ulcers have the character above described, and do not spread rapidly, whereas in cancer the ulcer is generally circular in shape, has eroded edges, and spreads very rapidly.

Syphilis may be also present in the form of syphilitic tubercles. These are generally found deeply situated in the substance of the tongue, and are round, hard, indurated, and irregularly circumscribed masses. The surface of the tongue above them is redder than natural, and has more or less of a coppery color.

The treatment consists in the administration of small doses of bichloride of mercury; either alone, or with iodide of potassium in the decoction of sarsaparilla, or some other convenient vehicle. They are very difficult to get rid of, and the treatment must be continued patiently for a long time. Local applications do not seem to have much effect. [Yet they should not be entirely omitted. One of the best will be, a combination of equal parts of pulverized alum, prepared chalk, and gum arabic.—H.]

Another condition of the tongue, which is sometimes due to syphilis—but which, judging from some cases I have lately seen, is certainly not always due to that poison,—is that described as a psoriasis-like or eczematous condition of the tongue, when the tongue becomes glazed, smooth, and fissured in places, not at all indurated, and resembling more than anything else a piece of raw beef. In these cases, there has generally been more or less derangement of the digestive organs, but not sufficient to interfere seriously with the patient's health; in fact, with the exception of the discomfort produced by the condition of the tongue, the patients have been otherwise well.

Treatment in those due to syphilis is the same as for the syphilitic ulcer. In the other cases I have tried almost everything, and am loth to confess that they were, when discontinuing from a three or four months' attendance at the hospital, much in the same condition as when they came. Nothing seemed to do much good, yet I found that a general tonic treatment, with a careful attention to the healthy performance of all the natural functions, and the restriction of the diet to the most easily digestible food, gave the greatest relief.

9. Salivation—Ptyalism.

An increase in the secretion of the saliva sometimes occurs to such an extent as to flow from the mouth, or necessitate its frequent discharge by spitting.

Excluding that produced by the action of medicines, the most common cause of an inordinate increase in this secretion is inflammation of the mucous membrane of the mouth, and consequent irritation of the salivary glands. Thus it is seen to be common in ulcerative stomatitis, cancrum oris, &c. Various gastric disorders have the same effect, as nausea, &c.

Pyrosis has by some authorities been considered to consist of nothing more than saliva swallowed—an opinion which has received some support from the observation of Frerichs, that it sometimes contains a considerable quantity of sulpho-cyanide of potassium; but Dr. Wilson Fox thinks that this admixture may be due to some saliva swallowed, or mixed with the fluid during its ejection.[1]

Any disorder of the throat, as tonsillitis, also causes great increase of saliva.

It sometimes accompanies pregnancy, and in certain diseases, as hysteria, hydrophobia, and some states of mania, it is not uncommon.

Generally, salivation subsides on the removal of the cause by which it originated; if not, astringent washes may be used.

The salivation produced by medicines differs much from the idiopathic disease.

Mercury is the medicine by which it is most frequently produced; but various preparations of gold, copper, lead, arsenic, antimony, and bismuth, sulphuric acid, iodine, and iodide of potassium, with castor-oil, foxglove, and prussic acid, have also been the cause of it in some people.[2]

Among the first symptoms of mercurial salivation is noticed a coppery taste in the mouth, soon followed by swelling and tenderness of the gums, and increase in the salivary secretion. The breath soon

[1] Reynolds's System of Medicine, Diseases of the Stomach, *ante*.

[2] Guy's Forensic Medicine.

becomes very fetid. As it progresses the teeth become quite loose, the gums very much swollen and spongy, and the tongue large and flabby, covered with thick white fur, with at the edges indentations corresponding to the teeth. Extensive ulceration may set in on the gums, spread over the whole mucous membrane of the mouth, and sometimes takes on a gangrenous character. The face and neck are also more or less swollen, and the glands in the neighborhood become inflamed, tense, and very tender.

With this severe local inflammation there is always more or less heat of skin, frequent pulse, much thirst, and entire loss of appetite. The gums and teeth, in the early stages, become so tender, that it is impossible for the patient to take any solid food.

The duration of this condition is very variable; it may not last for more than a few days in some people, whilst in others it lasts for some considerable time after the mercury has been stopped.

In very severe cases the whole mouth, with its appendages, is so much swollen that it can hardly be opened; the patient is utterly unable to articulate, and deglutition is scarcely possible. The inflammation may extend to the throat, and there is generally intense pain in the gums and teeth.

The ulceration about the teeth may be so extensive as to render them so loose that they easily fall out, and even portions of the maxillary bones may be denuded and exfoliate.

TREATMENT.—Mild cases of mercurial salivation require no treatment; they get well immediately on leaving off the mercury.

Severe cases, however, require much care and attention. If there is much pain, opium should be given to relieve it, and chlorate of potass in doses of ten grains in decoction of cinchona should be given every four hours. The mouth should be frequently washed out with warm non-irritating washes at first, and then, as soon as the inflammation begins to subside, with slightly astringent liquids. The ulcerations, when present, may be treated as in ulcerative stomatitis, with alum, nitrate of silver, &c.

Fetor of breath may be corrected by the use of solutions containing free chloride, Condy's fluid, carbolic acid, or creosote.

A solution of acetate of lead—two or three grains to the ounce—has been much recommended in these cases, and at first it may be combined with a little opium to allay pain.

10. MALADIES OF DENTITION.

Before speaking of these diseases, it will not, perhaps, be out of place here to notice first a few facts with regard to the natural process of dentition.

The teeth are developed in two sets; the first set called the milk teeth: the temporary or deciduous set are smaller and less numerous, to suit the size of the jaw, than the second or permanent set.

The milk teeth are twenty in number—four incisors, two canines, and four molars in each jaw.

Mr. Marshall gives the following formula of them:—

$$\frac{M_2\ C_1\ I_4\ C_1\ M_2}{M_2\ C_1\ I_4\ C_1\ M_2}.$$

They make their appearance in the following order:—

The central incisors	between the	5th	and	7th	months
" lateral	" "	6th	"	9th	"
" first molars	" "	9th	"	15th	"
" canines	" "	15th	"	18th	"
" second molars	" "	18th	"	24th	"

The lower central incisor is generally the first to appear.

Cases, though, have been observed where at the time of birth one or more teeth have been present, and others in which no teeth have appeared for more than two years.

Delayed dentition is, however, always due to rickets, whilst precocious dentition has been said to be due to a tubercular disposition, but this is rather doubtful.

The permanent set of teeth, thirty-two in number, consist of four incisors, two canines, four bicuspids, and six molars in each jaw. Formula according to Mr. Marshall:—

$$\frac{M_3\ B_2\ C_1\ I_4\ C_1\ B_2\ M_3}{M_3\ B_2\ C_1\ I_4\ C_1\ B_2\ M_3}.$$

They make their appearance in the following order, the first being the anterior molars:—

Four anterior molars	at the	7th	year.	
" central incisors	"	8th	"	
" lateral "	"	9th	"	
" anterior bicuspids	"	10th	"	
" posterior "	"	11th	"	
" canines	"	12th	to	12½ years.
" second molars	"	12½	"	14th "
" third "	"	18th	"	25th "

First dentition:—

The process of dentition varies considerably in different children. It is almost always accompanied by more or less pain and discomfort; yet sometimes they are so slight as not to draw attention to the process, and it is not till the tooth is seen to be through, by examining the gum, that dentition is known to be going on.

At other times it is accompanied with great pain, swelling, and tenderness of the gums. They look tense and shining, and the position of the tooth is marked

some time before its irruption by a distinct prominence on the edge of the gum.

The mouth is hot; the whole mucous membrane may become red; there may be a great increase in the secretion of the saliva, with a tendency to aphthous ulcerations about the corners of the lips and on the tongue. With this local inflammation there is always more or less febrile disturbance. The child is very feverish and irritable, frequently crying out as if in much pain, and passing very restless and sleepless nights. In these cases it is not unfrequent for small unhealthy ulcerations, with a sloughy appearance, to form on the summit of the gum, or around any tooth which has partially passed through it. (Odontitis.)

All degrees may be noticed between this latter state and the normal, almost painless, process.

The various diseases which may complicate dentition are diarrhœa, cutaneous eruptions, cough, vomiting, various forms of inflammation of the mucous membrane of the mouth, and different affections of the nervous system, especially convulsions, essential paralysis, and strabismus.

It is, however, very essential to remember that although any one of these diseases may exist as a complication of dentition, yet such disease may exist at this time and be entirely independent of it; and sometimes the difficulty of distinguishing its true cause is very great, and cannot be at once determined.

The chief distinguishing symptom is the disappearance of the complication as soon as the evolution of the tooth is completed. Barthez and Rilliet also assert that when these diseases exist as complications of dentition, the constitutional disturbance produced by them is not so severe as when they are idiopathic. The symptom is the whole of the disease; the cough is not accompanied by râle; the diarrhœa is slight, and shows no other symptom of enteritis; and the vomiting, although very frequent during twenty-four or forty-eight hours, does not produce that grave condition observed when it is due to disease of the stomach.

Of the cutaneous eruptions, eczematous sores about the angles of the mouth and nose and behind the ears are very common, and some advise that these should be allowed to remain. The late Dr. Parrish, of Philadelphia, used to insist upon the importance, not only of not interfering with this salutary process of nature, but even of imitating it in cases of much obstinacy and danger, by keeping blisters open in the same situation.

Pruriginous strophulus is also very common during dentition.

There is no doubt that during the period at which dentition takes place all other diseases assume a much more serious aspect, and the danger depends, according to Guersant, on cerebral complications being much more frequent at this time than at others. Yet that the local irritation of teething seems to have nothing to do with this increased severity is rendered likely by it having been observed in many fatal cases of pneumonia, meningitis, &c., that the irruption of the teeth has taken place quite easily in the course of the illness. It seems to be more probable that the increased danger of all diseases occurring at this period is due rather to the active general development of the organism that is going on than to the irritation of dentition, which is only one of its local expressions.

With regard to the proper management of children during this period, it is absolutely necessary to recognize all that has been previously said about diseases occurring at this time not being necessarily connected with, or dependent on, the process of dentition.

Formerly by some, almost all the diseases of this period were considered due to the local irritation produced by teething, and the gum-lancet was used much more frequently than was necessary.

It is rarely indeed that the gums require lancing. It may be done with good results when the tooth is nearly through, when in at least a day or two it would rise through the gum; then some pain and irritation to the child may be relieved by cutting through the thin gum, and at once setting free the tooth: or if the gums be much swollen, shining, tense, and red, they may be scarified, to allow the escape of some blood and to relieve the inflammation; but in these cases it should always be explained to the mother why it is done; otherwise, the tooth not appearing soon afterwards, the mother will be disappointed, and think that the lancing has been improperly done. It may be necessary to do this two or three times before the tooth may appear. [The experience of many American practitioners favors a more frequent use of the gum lancet than is here recommended; the indications for it, which are above mentioned, occurring, in my observation, and that of others, really quite often. The danger of a tough cicatrix, spoken of by some authors, is imaginary, if clean incisions are made.—H.]

Again in cases of constitutional disturbance, as diarrhœa, vomiting, convulsion, &c., if the irruption of the teeth be actively going on, and the gums are much inflamed, lancing them will frequently do good.

If there be any fever, some simple febrifuge medicines may be given. Dr. West recommends bicarbonate of potass with citric acid; and if the child be very restless and irritable, two or three drops of

the tincture of hyoscyamus may be added to each dose.

The diet should be most carefully regulated, and it should be seen that the nourishment be not given too often. The heat and dryness of the mouth so often present cause the child to cry continually for the breast, for the sake of the soothing sensation produced by the milk; in this way the child is very apt to overload its stomach, and produce colicky pains, diarrhœa, and vomiting.

Tepid baths are also of great service in allaying irritation and general febrile disturbance.

If there are any small aphthous ulcers present, they must be treated as before described in Aphthous Stomatitis. Generally in these cases there is more or less disturbance of the digestive organs.

In that severe form of ulceration to which the name of Odontitis has been given, small doses of chlorate of potass have been found to have the most beneficial effect. Local depletion by leeches is also extremely useful, and one or two may be applied with very good effect behind the angles of the jaw.

In these cases the submaxillary glands frequently become much swollen and tender.

In the second dentition the local symptoms are of the chief importance. These are various neuralgiæ of the teeth and gums, caries of the teeth, inflammatory toothache, and the like, which are met with most frequently in weakly, strumous children. For such maladies, change of air, agreeable exercise, good living, with tonic treatment may be all that is required.

But during the cutting of the second set of teeth, and also during the development of the "wisdom teeth," various anomalous conditions of the digestive and nervous systems are often observed—such as irritative dyspepsia, chorea, and convulsions—which require the appropriate forms of treatment described elsewhere in this System of Medicine.

C. DISEASES OF THE FAUCES, PHARYNX, AND ŒSOPHAGUS.

By Charles E. Squarey, M.B. Lond.

1. Hemorrhage from the Pharynx.
2. Relaxed Sore Throat.
3. Common Inflammation of the Fauces.
4. Gangrenous Inflammation.
5. Follicular Inflammation.
6. Simple Tonsillitis.
7. Herpetic Tonsillitis.
8. Chronic Tonsillitis.
9. Tumors of the Pharynx.
10. Inflammation of the Œsophagus.
11. Perforating Ulcer.
12. Paralysis.
13. Dilatation.
14. Stricture.

1. Hemorrhage from the Pharynx.

This disease has been included in the article on Hemorrhage from the Mouth, and to those pages the reader is referred for its diagnosis and treatment.

Though rarely occurring in sufficient quantity to run from the mouth in a stream, slight hemorrhage, just sufficient to streak the saliva with blood, is not by any means unfrequent, and from its almost invariably being thought to come from the lungs on account of the hawking and coughing necessary for its discharge, it causes much anxiety to the patient and his friends.

The condition of the throat and the absence of any chest symptom render the diagnosis very easy in the majority of cases, and the use of astringent gargles, with the administration of tonics, will be all that is required to arrest the bleeding.

2. Relaxed Sore Throat. Catarrhal Relaxation of the Throat.

This disease, which is marked by uneasiness or soreness in the throat, attended with slightly increased vascularity, and with swelling and œdema of the parts affected, is rarely attended with any constitutional disturbance.

It is not an uncommon affection in people of feeble constitution, and in those leading irregular and intemperate lives.

More or less uneasiness in the throat, increased by swallowing, with a dry, hacking cough, are the symptoms complained of. In some cases there may be increased secretion with continual expectoration.

On examination, the throat is seen to be more or less relaxed and swollen, the swelling having a humid or watery appearance. The uvula is much elongated and œdematous, and, by hanging down on the back of tongue and epiglottis, it causes the dry tickling sensation and consequent cough so much complained of in this disease.

The larynx always participates in the general condition of the throat; the voice is altered in character, sometimes entirely lost, but more frequently only much weaker and hoarser than natural. Much talking invariably aggravates this symptom.

Very little increase in the vascularity of the parts is observed. The attack is rarely accompanied with fever; the pulse remains quite normal; the tongue is moist, flabby, and furred, and generally indented at the edges by the teeth; the bowels are somewhat constipated.

There is not any thirst, and the appetite continues much the same as usual.

In some cases there may be a little lassitude and headache, but in the majority of cases the throat affection is all that is complained of; the patients being otherwise in their usual health and able to follow their ordinary occupation.

The attack generally comes on quite suddenly; it is most frequent in spring and autumn, especially in damp weather.

It is most commonly produced by exposure to wet and cold; it may be secondary to an acute attack of inflammation of the throat, or it may depend on some derangement of the digestive organs.

Having once occurred, it is very liable to occur again.

The treatment in these cases is very simple. Tonics, as quinine, iron, &c., should be given to improve the general health of the patient; and the local irritation and relaxation should be combated by the use of astringent gargles.

By the use of the hand-ball atomizer, astringents may be very effectually applied to all parts of the throat. Tannin in solutions containing from 2 grs. to 10 grs. to the fluidounce; tincture of perchloride of iron, 5 to 20 ♏ to the f ℥; alum, 1 to 10 grs. to the f. ℥; and nitrate of silver ½ to 5 grs. to the f. ℥, will be found very useful.

The glycerole of tannin also would in such cases as these be most useful in bracing up the parts. It should be applied daily with a camel's hair brush.

The uvula, if it causes much irritation, and if it be not reduced in size by the astringents used, may be snipped off.

The diet should be good, consisting of easily digestible substances; and mild purgatives, such as the seidlitz powder, should be given when necessary.

3. Common Inflammation of the Fauces. Sore Throat. Angina Simplex.

A simple inflammation of the mucous membrane of the pharynx brought on by exposure to cold and damp. Some people are much more liable to it than others. Having once occurred, it is very liable to occur again.

The first symptoms are a sense of heat and dryness in the throat, with acute pain on swallowing, and more or less hoarseness of the voice. There is frequently a constant desire to cough without the patient being able to hawk up anything.

On examination, the fauces and pharynx generally are seen to be more or less inflamed, one side frequently more so than the other: the parts are swollen, and of a bright red color; or, in severe cases, of a darker, almost livid red hue, with a dry, glistening, velvety appearance. The uvula and tonsils participate in the general inflammation, and the former, much elongated and œdematous, is frequently the cause of the constant cough. Patches of coagulated lymph may be seen forming a false membrane over various parts of the soft palate and pharynx, and the tonsils are not unfrequently covered with little white spots, the increased secretion of the glands. The inflammation commonly extends to the Eustachian tube and causes partial deafness; and it may spread downwards into the larynx and trachea, causing hoarseness, loss of voice, the peculiar laryngeal cough, and, in severe cases, seriously impeding the respiration.

A viscid mucus is after a time secreted and clings to the posterior part of the pharynx, causing a constant desire to expectorate. It sometimes very closely simulates the false membrane of diphtheria, especially in those cases where it is so viscid that coughing will not remove it.

Its position at the back of the pharynx, its smooth and regular edges not surrounded by a bright red margin of inflammation, will in most cases render the diagnosis easy: if not, its ready removal by the finger, without causing excoriation or bleeding, at once decides the case.

More or less injection of the skin is always present, and in some cases it is so bright as to resemble somewhat the rash of scarlet fever: but in these cases the injection is always limited to the face and neck, the upper part of the chest, and to the hands and forearms; it does not spread from these parts over the rest of the body, and it consists of a simple blush; it has not any of those fine red punctæ which are characteristic of the rash of scarlet fever.

The disease is always accompanied with some constitutional disturbance; in many cases its invasion is marked by slight rigors, headache, and aching pains in the limbs. The tongue is broad and flabby, with a thick, yellowish, creamy fur on the dorsum, the breath always more or less fetid, and the bowels generally constipated. There is much thirst, and entire loss of appetite. The temperature in many cases that I have taken has always been between 101° and 102° Fahr., the pulse varying from 100 to 120 beats in the minute.

The heat and dryness of the throat cause much discomfort, which on all attempts to swallow is intensely aggravated, the pain in some cases being very severe. Drinks not unfrequently regurgitate through the nostrils, and there is much pain and stiffness about the angles of the jaws. All the symptoms are much aggravated at night, and towards morning, on account of the mouth having become dry during sleep.

Duration.—In ordinary cases the inflammation runs on for about a week, and then gradually declines, terminating almost always in resolution. In weakly subjects suppuration may take place in the soft palate or in the back of the pharynx, or even superficial gangrene of the

inflamed parts may occur; but both are very rare: the latter especially, as it is much more common in these patients for the throat to get into the relaxed condition previously described.

The presence of pus is easily diagnosed by the swelling and by the fluctuation felt on passing the finger down the throat —it should be immediately let out by a free incision.

The prognosis in all cases is good, though sometimes the cure is tedious. The only danger is the extension of the inflammation to the larynx.

CAUSES.—The most frequent cause of this complaint is exposure to damp and cold.

All causes tending to lower the general health predispose to this affection: overwork, especially when combined with the effects of a vitiated atmosphere, as is so often found in hospitals, gives rise so constantly on the least chill to this affection, that the name "hospital sore throat" is very commonly applied to it. It is chiefly met with during puberty and adult age, but may occur at all ages. One attack predisposes to others.

TREATMENT.—In all cases the treatment should be commenced by a dose of calomel at night,[1] followed the next morning by the common black draught or some saline aperient; and this, with the frequent use of steam inhalations and the external application of hot fomentations, will frequently cut short the attack. If there is much swelling and pain, and the attack be accompanied with much fever in an otherwise strong and healthy constitution, two or three leeches may be applied with much benefit behind the angles of the jaws.

After the bowels have been freely opened, chlorate of potass in 10-grain doses, with a little dilute hydrochloric acid (♏x to ♏xv) in tonic syrup of orange-peel and water, should be given every four hours. The diet should at this time consist of strong beef-tea, milk, and eggs; no stimulants are necessary, unless the patient be weak and low; he should be kept in a uniform temperature and as quiet as possible. Barley-water, linseed tea, or any other mucilaginous drink, may be taken *ad libitum*, and they frequently give great relief when there is much dryness and heat of throat.

If suppuration takes place, directly it is detected a free incision should be made to allow its escape. In making the incision the knife should be directed slightly towards the median line, and it should be made at the lowest point, so that there may be no bagging of pus below the opening.

After the inflammation has subsided quinine should be given, the diet improved, and port-wine, when obtainable, taken two or three times a day. If the throat seems inclined to get into a chronic relaxed condition, astringent gargles or inhalations should be used combined with the internal administration of the tincture of the perchloride of iron in 20-minim doses every three hours.

It is well in all cases, if feasible, for the patients to get some little "change of air" before returning to their work, especially when their occupation is such as to confine them indoors.

[1] This is most frequently omitted now in American practice. From six to ten grains of quinine are more often given.—H.]

4. GANGRENOUS INFLAMMATION OF THE FAUCES.

This occasionally results from a severe attack of Angina Simplex in patients whose health has been previously much impaired by insufficient nourishment or by some acute disease. Of two cases that I have seen, one occurred after a severe attack of typhus fever, the other in a poor Irish laborer, who had been out of work for some time and had been living very badly.

In both cases the whole of the fauces was covered with an ash-gray slough; the gangrene was quite superficial. There was intense pain and great difficulty in swallowing, the drinks regurgitating through the nostrils. The breath was very fetid, and the patients were very weak and low.

The free application of nitrate of silver, with the use of gargles of chlorate of potass, and the internal administration of chlorate of potass in decoction of cinchona bark, together with a good nourishing diet and stimulants, speedily produced a healthy action, and both cases got well.

5. FOLLICULAR INFLAMMATION OF THE PHARYNX.

Follicular Pharyngitis, or Ulcerated Sore Throat, is an inflammation of the pharynx, limited chiefly to the follicles, causing much pain on swallowing, huskiness of the voice, and constant desire to hawk or spit. It frequently ends in ulceration. It is rarely accompanied by much constitutional disturbance.

Acute pain on swallowing is the first symptom complained of; it may be preceded by slight discomfort in the throat, but this is generally not sufficient to attract much attention.

On examination, the throat is seen to be more or less congested and reddened

throughout its whole extent, and studded with hard round or oval granular masses, surrounded by a bright red margin of inflammation; these little masses are the inflamed and swollen follicles of the pharynx. The centre or summit of these has a whitish transparent appearance, the orifice of the follicle; and if the inflammation does not now subside, these give way, a little white matter is discharged, and there remains a round or oval-shaped ulcer, which in healthy people soon cicatrizes.

In severe cases, if the inflamed follicles are numerous and close together, the resulting ulcers may unite and form one large ulcer; but this is very rare.

The inflammation almost invariably extends into the larynx, causing huskiness and pain, which are much aggravated by talking, and sometimes followed by aphonia.

Although causing much pain and discomfort, this disease is only in very severe cases accompanied with any constitutional disturbance. Ordinarily the pulse remains quite normal, the tongue a little furred, and the appetite only slightly impaired, though for two or three days solid food cannot be taken on account of the pain on swallowing.

The disease generally lasts for a week or so, in some cases much longer, and it may pass into a persistent chronic state, especially in weakly subjects, and when the weather is unfavorable.

It is brought on by exposure to cold and wet; and, as in the previous disease, some people are much more liable to it than others, the slightest changes in the weather being sufficient to produce it in them. Derangements of the stomach, the use of spices and hot drinks, have been mentioned amongst other causes.

All conditions tending to impair the general health predispose to this affection. It is chiefly met with in adults; it is rare in the young and at the later periods of life. One attack predisposes to others.

The treatment in these cases may be beneficially commenced by a dose of calomel, followed in two or three hours or the next morning by a saline aperient. And after the bowels have been effectually opened, tonics, such as quinine and iron, may be given three or four times a day; or the chlorate of potass—in 10-grain doses, with a little dilute nitric acid—in decoction of cinchona bark.

The ulcers when present should be touched with the solid stick of nitrate of silver; and if secreting freely and causing much fetor of breath, solutions of carbolic acid—m xv. of concentrated acid to the ounce of water—or of chloride of lime applied by the hand-ball atomizer, or inhalations of creosote, will rapidly give great relief; other astringents, as alum, sulphate of copper, or acetate of lead, may also be used, either as gargles or in the form of the medicated spray. [Iodoform may be carefully but confidently used; a small amount of the powder being applied directly with a camel's-hair pencil upon the ulcer.—H.]

The diet should consist of sops and mucilaginous drinks whilst there is much pain; the latter, by moistening the parts frequently, give great relief.

Various other ulcers are met with in the throat: they occur in the course of different diseases; as scarlet fever, typhoid fever, smallpox, or syphilis, and they sometimes are due to the action of mercury.

Those produced by syphilis are the only ones which are liable to be confounded with the ulcerated sore throat just described. They can, as a rule, be easily diagnosed by the following characters:—

Syphilitic ulcers are sharply defined, and are either circular in shape or serpiginous; their edges are swollen and indurated, and frequently have a distinct coppery tint; while the floor of the ulcer is gray. They cause little if any pain, and do not yield to ordinary treatment. The history and the presence of the symptoms of syphilis in other parts of the body will also aid the diagnosis. For further particulars, and for the distinctive characters of the other ulcers and their treatment, the reader is referred to the articles especially devoted to those subjects.

6. Tonsillitis.

Acute Inflammation of the Tonsils, Cynanche Tonsillaris, or Quinsy, is an inflammation of the substance of the tonsils, either one or both, and is accompanied with much constitutional disturbance.

The invasion of this disease in all but very mild cases is marked by a general feeling of malaise, by headache and aching pains in the limbs, with a sense of chilliness, or even distinct rigors; and at the same time there is felt some dryness or uneasiness in the throat, with acute pain shooting towards the ears on swallowing. The local and constitutional symptoms begin at the same time.

The uneasiness in the throat increases until it amounts to severe pain; swallowing becomes very difficult, and so painful as to cause a convulsive contraction of the features on each attempt; the pain shooting towards the ears. There is much tenderness behind the angles of the jaws, and they become so stiff that the patient with difficulty opens his mouth sufficiently for a thorough examination to be made.

The glands of the neck become enlarged and hardened, and not infrequently the neck itself is somewhat swollen and stiff.

As the disease advances, swallowing becomes almost impossible; fluids regurgitate through the nose, the mouth feels choked up from an increased secretion of tenacious saliva, the voice is much weakened and sometimes acquires a nasal twang; and in bad cases it may be entirely suppressed. There is more or less deafness, and if both tonsils are very much swollen there may be a sense of suffocation on lying down, owing to the fauces being blocked up by the swollen glands; this more frequently occurs in children than in adults.

On examination in the early stages of the disease the fauces are seen to be redder than natural, with the tonsils projecting slightly between the palatine arches. They gradually increase in size, and if both are affected they meet in the middle line. On their surface are seen, here and there, little white or yellowish spots, the increased secretion of the glands; these, when numerous and close together, form patches not unlike the false membrane of diphtheria. The uvula and soft palate always participate in the general affection, and the former, much swollen and elongated, is generally seen sticking to one of the tonsils.

The fever and general prostration that accompany these attacks are always very considerable. In many cases in which I have taken the temperature it has always been over 102° Fahr. In one case it was 104° Fahr. on the fourth day of the attack. The skin is moist and more or less injected, as in the Angina Simplex previously described. The pulse ranges between 100 and 120. The tongue is covered with a thick, yellowish, creamy fur; the bowels are usually much constipated, and the breath is intensely fetid. There is generally much restlessness, especially at night time, and in severe cases there may be a little delirium.

These attacks vary greatly in severity. In mild cases, and in those coming under treatment in the early stages of the disease, the inflammation may terminate in resolution, but in most cases suppuration takes place. The presence of matter is indicated by the soft elastic feeling of the tumor, and generally distinct fluctuation can be felt. If no incision is made in it, a day or so before the matter escapes, a pale yellowish spot will be seen on the surface, indicating the point at which the matter tends to escape. Up to this time the patient suffers intense pain, but immediately on escape of the matter great relief is obtained. It generally occurs during some effort made by the patient in coughing, swallowing, or clearing his throat; it may, however, occur during sleep, without the patient being conscious of the time when it took place.

After the opening of the abscess recovery is generally very rapid, though for some time afterwards the tonsils may remain swollen and indurated; this is especially likely to happen in weakly, scrofulous patients, or after repeated attacks of the disease.

Both tonsils may be affected, but it is generally only on one side that suppuration takes place. The disease almost invariably terminates favorably. It takes about five or six days to arrive at its height, sometimes longer, in one case under my notice lasting till the tenth day."

The urine during the acute stage has been, in the cases I have examined, much diminished in quantity, very high-colored, and of high specific gravity. The urea in one or two cases was a little above the normal quantity; the chlorides were almost entirely absent. No albumen was present at any time.

This disease is most common during youth and adult age. Some people are extremely liable to it. One attack predisposes to others, yet those who have suffered from it when young generally cease to do so when they become old.

Its most frequent cause is exposure to damp and cold, so that it is most common during the spring and commencement of the winter.

TREATMENT.—In all cases the treatment should be commenced by free purgation, such as may be obtained by a dose of calomel, followed by a saline aperient draught. After this has thoroughly acted, chlorate of potass may be given, as in the previous throat affections. Hot fomentations should be applied, and these should pass up from underneath the chin to the top of the head, not round the neck. They should be changed frequently, and put on as hot as the patient can bear them. Steam inhalations should at the same time be used every three or four hours, and these will be found to give great relief.

The diet should be as nourishing as possible, and at this time should consist of strong beef-tea, eggs, and milk; if the patient is very much prostrated, brandy or port-wine may be given.

Immediately that any fluctuation can be felt, or even before, if there is much pain, a free incision should be made into the tonsil, the knife being directed slightly towards the median line; even if no matter escapes, the bleeding will give more or less relief.

If there is much restlessness at night, an opiate may be given, and the best form is the Dover's powder, 10 grains mixed up with mucilage and water.

After the acute symptoms have passed by, tonics, such as quinine and iron, may be freely given. The diet should be very good, and plenty of port-wine taken; if the tonsils remain large, the tincture of

the perchloride of iron should be given in doses of from ♏xx to ♏xxx every three or four hours, and the tonsils may at the same time be painted over with a solution of equal parts of the tincture of iron and glycerine. Painting the enlarged tonsils daily with a strong solution of nitrate of silver has also been recommended; but in the majority of cases, where they remain so large as to cause serious discomfort, it will be necessary to excise them. [This is most conveniently done with Fähnestock's "guillotine" instrument. It is not necessary to remove the whole gland.—H.]

7. Herpetic Tonsillitis.

This is a vesicular disease attacking the tonsils and the inside of the mouth generally.

Herpetic eruption may occur on any part of the oral cavity. On the mucous membrane of the mouth it much resembles aphthæ, and gives rise to the same symptoms—that is, more or less discomfort or pain on chewing hard substances, taking hot drinks, or eating highly-seasoned food; it gets well in a few days without treatment.

When occurring on the tonsils or pharynx, it in some cases gives rise to much constitutional disturbance.

The invasion of the disease is marked in these cases by rigors and general malaise, followed at the end of twenty-four or thirty hours by a sharp burning sensation in the throat, and intense pricking pains shooting towards the ears on swallowing.

Generally one side only is affected.

On examining the throat, the tonsils and pharynx are seen to be of a bright red color, and swollen, the former projecting between the arches of the palate; and, if seen sufficiently early in the disease, a distinct vesicular eruption will be observed.

Generally, when first seen, the vesicles have already ruptured, leaving the appearance of little white spots on the tonsil, due to the macerated condition of the epithelium; or if the epithelium has been washed away, there are to be observed bright red excoriations or ulcers.

According to Trousseau, these spots may be now covered with a soft yellowish pultaceous exudation, and if the eruption has been copious, portions of this exudative matter may join together and form irregular-shaped patches much resembling the false membrane of diphtheria.

From the pharynx the inflammation may extend into the larynx, and cause some trouble and anxiety. The exudation remains for a day or so, then falls off, and the parts return to their normal condition.

There is sometimes a considerable amount of pyrexia present, the pulse may rise to 120, or even higher, the tongue is more or less furred, the appetite entirely gone, there is some thirst, and generally slight constipation.

The disease runs to its height in a few days, then as rapidly gets well.

It is generally produced by exposure to damp and cold.

Herpetic Tonsillitis may be the only morbid condition existing, but more frequently it coexists with some other acute disease, as pneumonia, pleurisy, intermittent fever, and certain catarrhal maladies.

Its relation to these diseases is at present entirely unknown. Its presence is neither of good nor bad augury with regard to the probable issue of the disease which it accompanies.

Its Diagnosis from diphtheria is in many cases extremely difficult, especially when it is not accompanied by any herpetic eruption on the face or elsewhere. The general condition of the patient will be the great guide in these cases, the constitutional symptoms being not nearly so severe in this affection as in diphtheria; yet it must be borne in mind that the latter disease is frequently very insidious in its origin.

In all cases of doubt, and especially when diphtheria is epidemic at the time, the patient should be treated for the graver malady.

The Treatment of the herpetic affection is very simple. The bowels should be relieved by mild purgatives, as the seidlitz powder, and iron or chlorate of potass should be given internally, as mentioned in the previous pages.

Slightly astringent gargles of alum or borax may also be used. Mucilaginous drinks and sops should be taken for the first day or so, and then the diet should be improved as the patient desires.

8. Chronic Tonsillitis. Hypertrophy of the Tonsils.

A chronically indurated and enlarged condition of the tonsils is sometimes the result of repeated attacks of inflammation; but it occasionally arises independently of any inflammatory origin, in weakly, scrofulous children.

The enlarged tonsils cause sometimes much difficulty in swallowing and in breathing—the latter is always more or less noisy. They are also extremely liable to fresh attacks of inflammation on the least exposure to damp and cold, and may then become so large as to cause suffocation by completely blocking up the throat.

In weakly, delicate children, if the respiration is much impeded, they may cause some deformity of the chest.

Under the influence of a course of tonic treatment, the swellings may subside as the child grows older; but if not, and they are causing any distress, they should be excised.

9. Tumors of the Pharynx.

Retro-pharyngeal Abscess is a term applied to denote a collection of pus in the cellular tissue posterior to the pharynx, and situated between it and the cervical vertebræ.

It is not a very common affection, and is more frequent in children than in adults, resulting from acute pharyngitis, from disease of the cervical vertebræ, or it may occur in the course of the acute specific fevers.

The Symptoms are, pain at the back of the pharynx, with difficulty of swallowing, and sometimes much oppression of the breathing. When high up, it can be seen forming a tumor at the back of the pharynx, and on touching it distinct fluctuation will be felt. When lower down, the diagnosis is not so easy; but difficulty of swallowing, oppression of the breathing, with deep-seated pain in the pharynx coming on rather rapidly, are the symptoms which should lead one to suspect it. A bougie might be passed to find out where the obstruction lies.

It is always very serious—many fatal cases have been recorded, and one occurred under my notice at the London Fever Hospital.

The Treatment is to open the abscess as soon as possible; the incision shou'd be made in the middle line at the lowest part of the tumor, to favor the escape of pus and to prevent bagging. The patient will require much support. Stimulants should be freely given, and nutritive enemas or the stomach-pump used if necessary.

Polypi of the Pharynx.—These generally spring from the posterior nares, and hang down into the pharynx, blocking up and rendering difficult the act of swallowing, and sometimes causing oppression of the breathing. They may arise from the sides of the pharynx, but when having this seat they are generally malignant growths.

On examination, the disease is at once detected. The treatment is removal.

Cancer of the Pharynx.—A cancer may arise from the walls of the pharynx—it is then generally epithelial; but it is more frequently connected with the cervical vertebræ, and grows forward, forming a tumor, at last eating its way into the pharynx.

It is easily recognized by the peculiar characters of cancerous tumors, by the implication of the neighboring glands, and by the cachectic condition of body which is its accompaniment.

The Prognosis is always most grave; and the Treatment consists in the alleviation of pain by opium or other sedatives, and the careful support of the patient by food and stimulants.

10. Œsophagitis. Inflammation of the Œsophagus.

This is a very rare disease, and usually arises from mechanical violence or from the direct application of irritating or corrosive substances.

The Symptoms are entirely local, consisting of pain along the course of the œsophagus, increased by swallowing, accompanied with expectoration of a thick viscid mucus, or flakes or tubes of false membrane sometimes tinged with blood. The pain may be referred to the epigastrium, or it may be between the shoulders; there is sometimes tenderness on deep pressure.

Very little is known concerning the simple inflammatory state; when due to mechanical violence,—as from the use of the stomach-pump,—soreness, with pain and some difficulty on swallowing, are felt for a few days, and then the patient is well. If due to acrid poisons, ulceration and stricture generally result.

The most frequent causes are direct application of some acrid, corrosive, or hot substance—taken either accidentally or suicidally—and mechanical violence from sharp rough foreign bodies introduced into the œsophagus, or from violence in the use of the stomach-pump.

It may be propagated downwards from the fauces or larynx, as in diphtheria and thrush. It may arise in the course of some of the acute specific fevers, as scarlet fever, smallpox, and typhoid fever, but the ulcer produced by this latter disease does not tend to contract afterwards. It may be secondary to syphilis. When occurring in the course of other diseases, it is rarely to be recognized during life.

At the post-mortem examination, the mucous membrane is seen to be of a deep red color, and covered with more or less soft and granular lymph.

Cases have been recorded in which the œsophagus has been found completely lined with false membrane.

The difficulty in the diagnosis consists in distinguishing it from similar conditions of the stomach.

PROGNOSIS.—It generally terminates in resolution; but if it gets into a chronic state, it may cause thickening of the coats, and stricture.

The TREATMENT consists in relieving the symptoms by warm poultices, and the application of two or three leeches or blisters to the neck or epigastrium.

Opium should be given to relieve pain. A mild course of mercury should be tried if the disease becomes chronic. The bowels should be carefully attended to, and the diet should consist of easily swallowed and nourishing materials.

11. PERFORATING ULCER OF THE ŒSOPHAGUS.

In these cases, the symptoms are the same as those of simple inflammation of the œsophagus, but they are aggravated.

The pain is more severe and more localized, the difficulty in swallowing is much greater, and the act is sometimes impossible; the expectorated mucus is always more or less tinged with blood.

It is liable to cause spasm of the œsophagus, and it is very important to remember this, as most serious injury may be done in these cases by attempting to pass a bougie.

The PROGNOSIS is always very grave.

The TREATMENT consists in relieving the symptoms and attending carefully to the diet and the bowels.

12. PARALYSIS OF THE ŒSOPHAGUS.

This disease is very rare. It is met with chiefly in the course of other diseases; thus it is seen in the last stages of progressive muscular atrophy, in glosso-laryngeal paralysis, in the paralysis of the insane, and in other nervous affections. It is one of the sequelæ of diphtheria, and it may be simulated by hysteria.

When not complete, solids are generally swallowed better than liquids. If complete, the patient must be fed by nutritive enemas, or the stomach-pump.

PROGNOSIS is always most grave, except when it occurs in hysterical patients.

TREATMENT.—When due to hysteria, the general conditions must be attended to; in other cases, the effect of electricity, blisters, and nux vomica, may be tried.

13. DILATATION OF THE ŒSOPHAGUS AND PHARYNX.

This disease is generally associated with stricture of the œsophagus, but it may occur independently of narrowing.

The dilatation may be in the form of a pouch, made either by distension of all the coats at one particular spot, or by protrusion of the mucous membrane between the muscular fibres (Œsophagocele); or it may be a general distension of the tube in some parts of its length.

The Symptoms in all cases are increasing dysphagia and regurgitaton of the food taken, after a longer or shorter interval. There is always a sensation as if the food was arrested a little above the stomach, and this in some cases gives rise to painful and protracted efforts to swallow. Immediate relief follows vomiting. The dilated part, when full of food, can frequently be felt as a tumor on one side of the neck, and can be emptied by pressure.

It is a disease of the prime and decline of life. Males are more liable to it than females.

Little can be done in the way of treatment. Bougies should be passed every now and then, and in passing them the instrument should be made to glide as nearly as possible along the posterior part of the larynx.

PROGNOSIS is always very grave, the patient sooner or later dying of starvation.

14. STRICTURE OF THE ŒSOPHAGUS.

Obstruction to the passage of food into the stomach may be due to spasmodic stricture of the œsophagus, to organic stricture, or to disease of neighboring parts compressing the œsophagus.

SPASM of the ŒSOPHAGUS.—A morbid contraction of the muscles of the tube, occurring in highly nervous hysterical subjects, and causing more or less difficulty in swallowing.

The Symptoms are—sudden difficulty in swallowing, coming on at irregular intervals and persisting for a longer or shorter time.

On attempting to swallow, the food is either rejected at once, if the spasm is at the upper part of the tube, or, if lower down, it is retained for a longer time and then regurgitates. Occasionally, when the food has been in contact with the stricture for some time, the latter yields, and some food finds its way into the stomach. Solids are generally swallowed better than liquids; but, as a rule, any sort of food causes the spasm. The attacks are sometimes accompanied with great pain, and are followed by great lassitude and depression.

A sense of constriction is often felt even when an attempt to swallow is being made; and this feeling in the throat constitutes what is sometimes termed the

Globus Hystericus. Occasionally the irritation extends to the larynx and lungs, and causes much embarrassment to the respiration, with a sense of impending suffocation.

The duration of the attacks is very various, some only lasting for a few hours, others continuing with more or less complete remissions for months or years.

From organic stricture—the only disease with which it can be confounded—it is at once distinguished by its sudden accession, and by the occasional remission of symptoms, allowing the patient to swallow quite easily. During a remission, a large bougie can be passed without difficulty; and even during the spasm, if the bougie be gently pressed onwards for some little time, the spasm will relax, and the instrument will pass into the stomach.

CAUSES.—In those predisposed to this affection the least irritation of the mucous coat is sufficient to bring on an attack.

The predisposition consists in an excitable state of the nervous system, such as is met with in hysterical and hypochondriacal people, together with an anæmic and debilitated condition of the body. Emotions of various kinds, diseases existing elsewhere, as affections of the larynx, stomach, or uterus, or in bad cases even the mere attempt to swallow saliva, may be sufficient to excite the spasm.

At the same time, it must be remembered that it may be produced by inflammation, or the presence of an ulcer in the mucous coat; so that in all cases in passing instruments the greatest care should be used.

The PROGNOSIS is rarely grave, although the cure in some cases is exceedingly tedious and difficult.

TREATMENT.—When due to hysteria, thorough change of air, exercise, occupation for the mind, and pleasant companionship should be recommended, together with the internal administration of tonics and antispasmodics.

Strychnia has been found very useful in some cases; and quinine in others where the spasm has been regularly intermittent.

Locally, warm poultices, the hypodermic injection of morphia, blisters, setons, &c., may be tried. In purely nervous affections the bougie should not be passed.

If due to inflammation or ulcer, the treatment must be that already indicated for those diseases.

ORGANIC STRICTURE OF THE ŒSOPHAGUS, and those diseases of neighboring parts which by pressure cause dysphagia, come properly within the domain of the surgeon, so that here only a short notice will be taken of them.

ORGANIC STRICTURE. — The chief symptom of this complaint is gradually increasing dysphagia.

At first this difficulty may be only felt at times; then it is always felt, though at some times much worse than at others—this being due to spasm, occasioned by irritation of the diseased parts. Years may elapse before any great difficulty occurs. At first solids are passed with difficulty, then they cannot be passed at all, and regurgitate.

Dilatation of the œsophagus above the stricture takes place in some cases; so much so, that large quantities of food can be taken, and will remain down some time—the patient always having a sensation of its "sticking somewhere"—and at last, when regurgitated, the pieces of food are generally covered with more or less mucus, a little blood, or pus. There is no acid reaction in the mucus coming from the œsophagus, and this fact is sometimes of service in the diagnosis from gastric disease. Some little quantity of food may pass the stricture and get into the stomach.

Arrived at this stage, emaciation commences, and proceeds very rapidly. There is rarely any great pain or hemorrhage.

The irritation and inflammation may extend to the larynx, and cause much oppression of the breathing; or, by implicating the recurrent laryngeal nerve, may cause continual cough. At last the patient dies from inanition.

The most common seats of the stricture are the upper third of the œsophagus and its cardiac end. When situated high up, the œsophagus is diminished in size below.

This is the general course of symptoms in stricture produced by disease of the œsophagus itself, such as cancer of the œsophagus, and induration and contraction of the walls from the action of corrosive substances.

When the dysphagia is due to diseases existing external to the œsophagus, the constriction is rarely so complete.

The various conditions which will thus cause dysphagia are—polypi of the pharynx, retro-pharyngeal abscess, post-pharyngeal tumors, as cancer, springing from the bodies of the vertebræ; œdema at the back of the epiglottis, tumors in the neck, such as enlarged glands; carotid aneurism, or enlarged thyroid; aneurism of the innominate artery, or of the aorta; intrathoracic tumors, such as enlarged bronchial glands; cancer of the apex of the lung, distended pericardium, dislocation of the sternal end of clavicle backwards, and impaction of foreign bodies in the gullet.

When due to aneurism, a bougie should never be passed.

For the characteristic symptoms and treatment of these various diseases the reader is referred to books on Surgery.

DISEASES OF THE DIGESTIVE SYSTEM.—*Continued.*

D. DISEASES OF THE INTESTINES.

1. Enteralgia.
2. Enteritis.
3. Obstruction of Bowels.
4. Ulceration of Bowels.
5. Cancerous and other Growths in the Bowels.
6. Diseases of the Cæcum and Appendix Vermiformis.
7. Colic.
8. Colitis.
9. Dysentery.
[10. Diarrhœa.]
[11. Cholera Morbus.]
[12. Cholera Infantum.]
13. Diseases of the Rectum and Anus.
14. Intestinal Worms.

ENTERALGIA.

By John Richard Wardell, M.D., F.R.C.P.

Definition.—Enteralgia is a painful affection of the intestines, of neuralgic character, generally accompanied with constipation and flatus. It may come on gradually in a dull and obtuse manner, but in the great majority of instances its supervention is sudden, and the pain is sharp and violent. It is, correctly speaking, visceral neuralgia, and mostly occurs in neurotic individuals. The common accompaniments of inflammation are absent. The skin is cool, the pulse is not accelerated, and the heart's impulse is rather subdued than augmented. Its attacks are paroxysmal. It shifts its position in the abdomen. It is often a pain reflected by distal disease, but if continuous it may end in inflammation.

Synonyms. — Enteralgia, Tormina, Dolor Colicus, Colicodynia, Spasmus Intestinorum (*various Authors*). Ileus Spasmodicus (*Sauvages*); Spasmus Ventriculi (*Wiessner*). Some writers have confounded it with Gastrodynia, or Gastralgia. In the vernacular the affection is identical with Pain of the Intestines, Spasm of the Bowels and Belly-ache, Pain in the Belly, Gripes, and Cholick, or Cholick Colic.

Causes.—The causes of this complaint are to be regarded as those which are *Predisposing* or *Remote*, and those which are *Proximate* or *Exciting*.

Under the head of the first named may be mentioned the influence of sex, and it is beyond dispute that females are more prone to this affection than males; their greater sensitiveness, and their susceptibility to moral emotions, favor the development of nervous diseases; and the sympathy of the uterus and its appendages, as familiarly known, in marked manner reacts upon the cerebro-spinal and ganglionic systems. The particular temperament of the patient will confer a proneness to, or tend to give an immunity from, this complaint, those who are nervous and melancholic being more liable to it, and those who are leucophlegmatic or lymphatic being less susceptible. The condition of asthenia conduces to the production of enteralgia, and a lowered vitalism is often associated with an exaltation of sensibility. The weakness resulting from acute or chronic disease, by depressing the tone of the system in general, and the functional power of the great nervous centres in particular, constitutes a common predisponent, and the morbid action of the nerves proper to some part or parts is not an unusual occurrence. During the convalescence of fever, after visceral inflammation and large losses of blood these

attacks are not infrequently witnessed. Excessive lactation, by subduing the general strength, often enters as an element into the remote causation; and the same may be said of menorrhagia, the lochia, hæmorrhoids, leucorrhœa, and like affections. Long-continued secretions and periodical discharges, by deteriorating and diminishing the vital fluids, are followed by the result in question.

Amongst the proximate or exciting causes is to be mentioned the malarial influence, and in tropical countries and aguish districts there is no doubt it often merits the accusation. Atmospheric humidity, low and damp situations, and a naturally cold and wet climate, form endemic conditions which foster the development of neuralgic ailments; and the truth of the converse is unquestionable that in places of greater altitude and in a purer and dryer air they are not so prevalent. When hot and sunny days are followed by frosty nights, the body being suddenly chilled, and thus the blood being determined to the internal organs, these anomalous pains are often produced. Wet clothes and wet feet give rise to the same affection. Mental fatigue, as after long-continued and great intellectual efforts, has by some writers been enumerated. In those persons whose vocations are such as to demand a continued strain of thought, or whose hopes and fears are excited by speculation, as in commercial enterprises, or those whose faculties are stimulated by some career of ambition, in all of whom the nervous functions are brought into great energy of action, these neurotic ailments prevail, sometimes being located in one organ or part, sometimes in another.

There are also proximate causes, which are strictly speaking pathological—which are referable to foregoing and obvious forms of morbid change, especially to those changes which take place in the blood, and which constitute a humoral causation to the nervous phenomena. It has been observed by Simon that central neuralgia arises with the utmost frequency in anæmiated and debilitated persons;[1] and we know how apt it is to follow hemorrhage, and be associated with malnutrition when no primary structural lesion exists. During the latency of the gouty, and in the rheumatic diathesis, when the *materies morbi* of those respective affections has accumulated in the system, before its explosive decomposition has been evinced by local inflammation and excessive secretional evacuation, its presence may be such as to generate that humoral disorder, which first affects the cerebro-spinal and ganglionic centres, and then the nerves proper to visceral organs. In chorea, which is consequent upon some perversion in the development of the blood, caused by the alteration of physical qualities, or the chemical relations of that fluid, or it may be by the absolute generation of some new product, we have ample testimony of the immediate effect produced on the nervous system. And in Bright's disease we are continually presented with examples of the same consequence, caused by the retention of effete and poisonous matters in the circulation. Dr. Todd[1] some time ago pointed out the fact that epilepsy, as associated with this renal affection, is characterized by greater severity in its seizures the longer the interval between the fits, because the irritant materials revulsed into the circulation are then in accumulation and act with greater force. The fact that defective blood-development, or its contamination by lesion of the depurative organs, is productive of nervous disorders, is well shown by the administration of suitable remedies. In anæmia and chorea we every day observe the beneficial effects of ferruginous medicines, and see how pains diminish in degree and frequency, and how the disorderly movements of the voluntary muscles become subdued. In hyperæmia, more especially in that form which has been denominated active hyperæmia, pressure upon the nervous filaments gives pain; and although such far more frequently obtains with the solid abdominal organs, yet it doubtless is an element entering into the causation of Enteralgia.

In organic disease of the brain and spinal cord pain is generally reflected to some distant part, and such is the common case in lesion of the last-named organ. In caries of the vertebræ, as I have in repetition observed, the reflected visceral pain has been a constantly recurring sign. Some years ago I saw, at the request of a distinguished provincial surgeon, a lady who for many weeks had been under his care, and whose case he regarded as one of persistent Enteralgia caused by some offending ingesta or some impaction of the bowels. I believed, however, that this pain in the bowels had a more remote origin—that it was spinal. The examination after death revealed vertebral caries and softening of the cord. Sometimes the distal pain can be traced to mechanical injuries of the nerve-centres. We know that in children there is the closest connection between encephalic disease and disorder of the bowels. In primary disease of the solid abdominal viscera, especially in that of the liver and spleen, irritation is not infrequently extended to the intestines; sometimes neu-

[1] Lectures on General Pathology, lect. x.

[1] Lumleian Lectures, Medical Gazette, 1849 and 1850.

ralgic pain of an intermittent or remittent character eventuates; while in active congestion of the liver, or in that sudden distension of the spleen which occurs in periodic fever, intestinal pain is no unusual symptom. The intimate sympathy which subsists between these parts can be well understood when we consider their ganglionic connection.

Amongst the more common causes may be mentioned indigestion and flatulence. When the ingesta have not been properly converted into chyme, but have passed down into the lower bowels only partly disintegrated, they give rise to irregular spasmodic attacks of pain by acting, as it were, like foreign bodies in the canal. In this way shell-fish, dried salt meats, pork, badly cooked food, unripe fruit, crude vegetables, and the like, are followed by the affection. That flatus very often produces Enteralgia is a fact so familiar as scarcely to merit comment; but numbers of the older authors speak of this cause with much emphasis.[1] Wiessner says: "Flatus similiter etiam ventriculum doloribus spasticis afficiunt. Hæc enim toti tractui intestinorum molestissima affectio vel ipsi ventriculo proxime nocet, vel partium distentione stomacho proximarum. Ex hisce imprimis colon transversum, ante inferiorem ventriculi curvaturam extensum, sedem aëri incluso quam maxime incommodam parat."[2] The movement of gases from one part of the intestines to another accounts for the shifting of the pain. Constipation is another and frequent cause of the complaint. Indurated masses of feces become impacted in the cæcum, sigmoid flexure, or transverse colon, and attacks of sharp, twisting, rolling pain come on from time to time, and are not permanently relieved until the irritative contents of the gut have been voided. Sometimes a large gall-stone or a concretion is the cause. Morbid secretions, acrid substances, acerb fruits, septic food, such as putrid game and bad cheese, stimulating liquors, and sour drinks are liable to produce Enteralgia. Chemical agents and medicinal compounds are followed by a like result. The sensitive fibriles proper to the lining tunic of the digestive tract, by coming in contact with the fore-named, become irritated, and there may be great pain when the motor nerves are but slightly influenced in their functions. In lead-poisoning the intestinal nerves are particularly prone to exaltation of sensibility.

[1] Rhodii Obs. Med. cent. iii. Palav. 1657; cent. ii. obs. 70. Lieutaud, Hist. Anat. Méd. tome i. p. 7; Paris, 1767. Marchand, Diss. de Cardial. flatul. Argent. 1754. Weikard, Vermischte med. Schriften, Frankf. 1778, b. ii. p. 143.

[2] De Spasmo Ventriculi, p. 13.

Symptoms.—The mode of accession is generally sudden, the pain being sharp, shooting, or twisting; but in some instances it comes on more gradually, and a rolling or aching of the bowels is described. The affection is, in the majority of cases, first felt at the umbilicus or in the right iliac fossa. The paroxysms increase in degree and frequency, the intervals from suffering being irregular and of varied duration. The pain, especially in the earlier stage of the attack, alters its position. It is rather relieved than aggravated by pressure. The skin is often cool, the face pale, and the pulse, instead of being accelerated, is rendered slower than natural. In the severer cases the stomach sympathizes, and sickness and vomiting may supervene; and when the malady becomes intensified and the agony excessive, the entire surface is bedewed with a chill, clammy perspiration, the extremities becoming cold and of venous hue, and the general aspect that of collapse. Costiveness is the common accompaniment, and percussion displays an overloaded state of some part of the colon, generally at the cæcum or sigmoid flexure. When flatus is the chief cause, there is intestinal distension, and such notably obtains in the large bowel. On palpation nodulated eminences are felt, which quickly alter in their configuration, and which are caused by the constricted and distended portions of the tube. With the expulsion of the confined gases the patient derives signal and immediate relief, and sometimes the amount evolved is very considerable. The noisy flatulent movements — borborygmi — which are often heard in the canal frequently constitute a marked symptom in hysterical females whose primæ viæ are generally disordered, and whose assimilative functions are imperfectly performed. The attacks of Enteralgia may be intermittent or remittent. Sometimes they terminate with all the rapidity with which they were ushered in. Although, as a rule, Enteralgia is apyrexial in character, yet inflammation sometimes occurs; and then the surface is warmer, the pain more fixed, and the circulation excited. In hysterical women uterine[1] disorder is the usual concomitant, and the enteralgic pain will often be found in association with spinal tenderness. In such instances percussion on the spinal processes should not be omitted, and not infrequently hyperæsthesia of the abdominal surface is a prominent sign. When the subjective symptoms are referable to organic disease, and are evidently reflected, the cerebro-spinal axis and the solid abdominal organs

[1] Or ovarian hyperæsthesia. See articles on Hysteria and Hystero-epilepsy in vol. i.—H.]

should respectively be examined, and the kind of lesion there existent be as far as possible correctly estimated. This neuralgic pain of the intestines is occasionally seen as a symptom caused by ulceration and congestion of the uterus; and it may come on after the sudden retrocession of cutaneous eruptions and the exanthemata; also, as before remarked, it may follow profuse critical evacuations, the repeated loss of blood by hæmorrhoids, or other sources of debility.

The symptoms are modified or terminated, or the attacks rendered less recurrent, by the accession of certain morbid conditions taking place in the system. The advent of a powerful diaphoresis, the supervention of diarrhœa, the flow of the catamenia, the lochial discharge, the occurrence of epistaxis, the formation of an abscess, or the return of some long-habituated secretion, are known to exert such influence. A fit of gout, or the development of acute rheumatism, seem on derivative principles to lessen this nerve-pain, and diminish in or remove from the organism those conditions of irritation which particularly affect the cerebro-spinal and ganglionic nerves. It sometimes happens, when the affection comes on in females, that a very large secretion of pale or almost colorless urine is at once succeeded by the mitigation of the attack. In some cases the abdominal and thoracic muscles are spasmodically contracted; there are rigidity of the recti, and a loss of motor power in the intercostals, the chest is fixed, and the breathing is oppressed. When the seizures become repeated, they are liable to be characterized by greater severity, the exaltation of the nervous sensibility doubtless becoming augmented by continued irritation. The duration of the symptoms is always most uncertain, as much will depend upon the kind of fundamental cause by which they are produced: it may, however, be regarded as the most usual fact that the more severe the fit the shorter will be its continuance. In children spasmodic pain of the bowels is soon productive of disorder in the digestive functions, and irritation in the alimentary tube is soon followed by the ordinary conditions which characterize infantile convulsions. According to M. Billard, the child cries suddenly and loudly, the face is contracted, the limbs are stiffened, the belly is tender to the touch, there is tympanitic distension, and the attack is often relieved by the expulsion of large quantities of gas *per anum*.[1] The alvine evacuations are generally suspended, and frequently there are vomiting and carpo-pedal contractions; in young infants there is tossing of the arms, the legs are drawn up to the abdomen, and often in the course of time green and offensive stools are voided. Frequently upon investigation it will be found that the mother's milk, or the artificial food which has been given, is the cause.

PATHOLOGY.—In the discussion of this part of the subject, those morbid conditions may first be noticed that consist of impairment of the functions of the bowels, which are characterized by alteration of sensibility, and which are often in association with a lowered state of vitality in the economy; but, as in all functional affections, the real origin of the complaint cannot always be detected, and remains an uncertain inference. It frequently happens that when some irritation of the mucous surface of the bowels is the cause, gases become generated, and painful dilatation of some part or parts of the tube is the consequence. It is probable that a great portion of the gas is secreted from the blood, for the flatus is often produced too quickly and in too great abundance for the presumption that it comes entirely from the decomposition of the ingesta. By this distension of any particular section of the gut there is loss of tone, the contractile power of the muscular coat may be almost or entirely abolished, and the pressure on the sensitive nervous fibriles occasioned by such dilatation will well account for the complaint, because there may be asthenia of this part of the ganglial system in accompaniment with morbid exaltation of sensibility. This irritation of the peripheral nerves, caused by harmful ingesta, concretions, vitiated secretions, and the like, affects not only the intestines themselves, but other organs also; and thus it is that the heart and diaphragm are functionally influenced, and hence the depressed circulation and difficult respiratory movement so commonly witnessed in the more violent examples of the ailment. As pain is often to be regarded as the prominent expression of some malady pervading the entire system, and as the functions of any organ may be thus disturbed, it not infrequently occurs that one or other of the viscera is the seat of such disease; and thus it is that in contamination of the blood spasmodic or neuralgic pain of the intestines may result. In saturnine poisoning there is ample illustration of this fact; the poison is transferred into the circulation, the secretions are arrested, and fits of agonizing pain are felt in the bowels: and so it doubtless occurs in those dyscrasial affections in which the fluids of the body are degraded by changes more occult, and by the operation of agents less plainly comprehended. In gout and rheumatism, and in Bright's disease, the cerebro-spinal and organic centres are secondarily influ-

[1] Traité des Maladies des Enfans nouveaux-nés et à la Mamelle. 8vo. Paris, 1828.

enced through debasement of the blood. When gout is retrocedent or rheumatism suppressed, their peccant materials are revulsed upon and irritate some of the internal organs; and in Bright's disease, when the urinary excreta are imperfectly eliminated, the disturbance of the nervous system is exemplified not only in the exaltations of sensibility in the viscera—neuralgia—but in perverted motor function, as evidenced in the reflex action of vomiting and diarrhœa. In simple asthenia, when there is excess of emotional and other motility, as in hysterical females, the kinds of pain in question are readily developed; and if it cannot be said that structural changes do not exist, at least they cannot be indicated.

When organic disease in some cognizable form does constitute the cause of Enteralgia, the examples may be most varied in their locality, degree of objective symptoms, and the kind and amount of their structural alteration. When the primary lesion is in the cerebro-spinal axis, chemical, physical, and mechanical aids to diagnosis are of no avail, and we are compelled to rely upon analogies and subjective representations.[1] One of the most frequent pathologic conditions is that of hyperæmia, which produces irritation and reflex phenomena. According to Brown-Séquard,[2] when the afflux of blood or other morbid change is at the posterior parts of the cerebro-spinal axis, hyperæsthesia is the common result; and it would seem that interruption of continuity of the vaso-motor nerves is the fundamental cause of vascular dilatations. In spinal irritation and hysteria reflex visceral pains thus doubtless arise; and it may truly be affirmed that the causes of spasmodic and neuralgic pains are more commonly central than peripheral—in figurative language, they are more frequently referable to the battery than to the conducting wires. In positive inflammation of the cerebral and spinal tissues abnormities of function must necessarily arise. The nerves are seldom diseased. Albers and West in only exceptional cases found the vagi morbid on inspections after whooping-cough. Bichat[3] repeatedly examined the nerves in diseases of the viscera without discovering pathologic change. But according to the testimony of various writers, and from my own observations, the nerves are sometimes inflamed, and are subject to other morbid alterations. The neurilemma is the part most prone to inflammation, and Craigie[4] asserts that such condition is a common cause of neuralgic pain. In tetanus and sciatica the entire nerve has been seen red and swollen. The sympathetic ganglia are sometimes diseased; there may be vascularity of the cellular tissue interposed between the elements of the ganglia, and the ganglionic substance has been seen enlarged and indurated. It is also highly presumptive that there may be molecular change in the contents of the ganglionic corpuscles. Neuromatous formations may be the cause of Enteralgia. As I have already remarked, the more common and obvious conditions of visceral disease may produce enteralgic pain, such as thickening of the inner tunics of the bowel, whereby impediment is given to the contents of the tube; an ancient band of lymph giving rise to constriction; or some abnormal growth pressing upon the gut. And in the various organic affections to which the solid organs are liable, reflected enteralgic pain is no unusual result. In diseases of the urinary and generative organs of both sexes the kinds of abdominal pain now spoken of not unusually supervene. Ulceration of the uterus and impaction of the ureters sometimes cause Enteralgia.

Diagnosis.—The diagnostic indications of Enteralgia are sudden, darting, plunging, or twisting pains, which come on paroxysmally, the attacks varying in their degree of severity and in their duration. The intervals between the seizures may be almost or altogether free from suffering. The pulse remains unaltered, the surface is cool, and the facial expression is that of pallor and pain. There is moist tongue, no thirst, the bowels are confined, and flatulent distension is the common accompaniment. Pressure on the abdomen relieves rather than augments the pain, and it is not unusual for the patient to press his hands on his belly during the paroxysm as a means of affording relief. The expulsion of gases from the large bowels gives immediate ease; and sometimes the advent of diarrhœa at once cuts short the complaint. In inflammation of the bowels pressure confers pain, the skin is hot and dry, the pulse quick, the face flushed, the secretions and excretions are diminished, the patient cannot turn and twist about in bed as he can in Enteralgia, and the objective symptoms of symptomatic fever are more or less proclaimed. In inflammation the pain is confined to one particular part of the abdomen, and only gradually becomes diffused. In Enteralgia it shifts about with great celerity. In ileus there is vomiting, and at length of fecal matters; a lump can often be felt, and the suffering, as in inflammation, does not intermit. When this neuralgia of the

[1] Sieveking, Manual of Patholog. Anat. p. 211.

[2] Lectures on the Central Nervous System, p. 205.

[3] Anatomie générale, i. 225.

[4] Pathological Anatomy, 2d edit. p. 380.

bowels is from impaction of feces, palpation and percussion will be our guides; if from concretions or mechanical obstructions, the history of the case and collateral circumstances will conduct to a right decision; and if from irritative secretions, a flux generally supervenes. If reflected by distal disease, as in hepatic, splenic, and renal ailments, those organs should be carefully examined. In neuralgia the pain radiates round to the back, generally at one side. In the passage of renal calculus the pain is in one side; it darts down towards the pubes and thigh, and in the male there is retraction of the testicle. In rheumatism of the abdominal muscles the disease pervades some other part. In hysteria the spine should be examined; and when from this cause, often a copious discharge of colorless urine will give relief. In lead-poisoning there will mostly be dropping of the wrists, and the blue line on the gums.

Treatment.—The remedies first indicated are those which are most likely to abridge and mitigate the sufferings of the paroxysm; and with this view antispasmodics and anodynes may be prescribed, such as opium, chloric æther, henbane, conium, camphor, ammonia, and similar agents.[1] At the same time hot fomentations, sinapisms, terebinthinate epithems, or stimulating and rubefacient liniments, may be employed [or, in obstinate attacks, anodyne hypodermic injections may be used.—H.]. The surface should be kept warm and diaphoresis promoted, which can be best accomplished by the patient first putting his feet and legs into hot mustard and water, and then going to bed. The warm bath and sedative enemata are excellent auxiliaries. Sometimes anodyne embrocations, addressed to the spine, do much good. In the more chronic neuralgic affections, I have long been in the habit of prescribing a liniment composed of laudanum, chloroform, the extract of belladonna, and the linimentum camphoræ. The bowels should afterwards be cleared out by mild laxatives, such as castor oil, the compound rhubarb pill, extract of colocynth in combination with extract of henbane, or the galbanum pill, or the confection of senna. When we believe the fundamental cause to reside in the solid viscera, or in the cerebro-spinal axis or ganglionic centres, our measures should then be addressed to such parts, and our aim be to lessen the general morbid excitability of the nervous system.

ENTERITIS.

By John Syer Bristowe, M.D., F.R.C.P.

The term Enteritis, signifying inflammation of the bowels, is of ancient date, and from the earliest times until now of more or less loose and various application. It has often been applied to a certain group of symptoms irrespective of the conditions under which they may arise, and irrespective even of the presence or absence of actual inflammation, as for instance to strangulated hernia, intestinal stricture, and other forms of obstruction of the bowels; and again the word has often been made to include various specific forms of disease attended with specific intestinal lesions, such for example as enteric fever, tuberculosis, and cancerous infiltration. It is intended in the present article to treat of Enteritis, according to its real meaning, as a simple inflammatory affection; and to eliminate from the subject, as far as possible, all reference to the diseases with which it may be confounded or on which it may supervene.

I. As affecting the Serous and Muscular Coats.—The intestinal tunics are all of them liable to inflammation either separately or in combination: and the inflammatory process, as it occurs in each, has a tendency to present characteristic peculiarities, and to be associated with special symptoms. Inflammation of the serous coat is of frequent occurrence as a part of general peritonitis, a disease the morbid anatomy and symptoms of which are subsequently described; but, as in the analogous cases afforded by the pleuræ and pericardium, inflammation commencing here spreads rarely, or with difficulty and late, to the subjacent tis-

[1] Oil of cajuput is one of the best of these; especially if any mixture of the gouty element be present. Its dose is from four to eight drops, conveniently taken on lump sugar. I have known firm pressure upon the two anterior superior spinous processes of the ilia to give much relief.—H.]

sues; and hence peritonitis may be considered practically to be as distinct from true inflammation of the bowels, as pleurisy is from pneumonia, or pericarditis from inflammation of the heart. Nevertheless inflammation beginning at the peritoneal surface does occasionally invade the whole thickness of the intestinal walls; and still more frequently, just as pneumonia induces inflammation in the overlying tract of pleura, inflammation of the deeper tissues of the bowel leads to circumscribed inflammation of the investing peritoneum, and to the superaddition of peritonitic symptoms to symptoms previously existing. The structures lying between the serous and mucous tunics, namely, the muscular laminæ with their associated nervous plexuses and connective tissue, are rarely the primary seat of inflammation; occasionally, it is true, in pyæmia and under other exceptional conditions, an abscess forms in them; but they are more frequently involved in the extension of peritoneal inflammation; and still more frequently they become inflamed either by the spread of inflammation from an inflamed mucous membrane, or in consequence of its simultaneous origin in the several intestinal tunics. Inflammation and its results here, in their slighter forms, scarcely reveal themselves to ordinary post-mortem examination, but when more pronounced are manifested anatomically by congestion and effusion of serum, lymph, pus, or blood. The symptoms which they induce are in the first instance probably spasmodic contraction of the muscular fibres, subsequently loss of power, or complete paralysis.

II. As Affecting the Mucous Membrane.—Inflammation as a primary and characteristic affection occurs far more frequently in the mucous membrane than in the coats external to it; and it occurs here in forms which vary considerably according to its cause, the constitutional conditions under which it arises or with which it is associated, and its degree of intensity.

(*a*) *Catarrhal Inflammation.*—The slightest and simplest form of inflammation is usually termed *catarrhal*. This may be produced by the local action of irritating ingesta, or by the influence of those external conditions which are known to be the agents in setting up the same kind of inflammation in other parts; and it is believed by some to attend generally scarlatina and other specific fevers.[1] Young children, particularly during the period of teething, seem specially liable to it. It is characterized by congestion, tumefaction, softening and dryness of the mucous membrane, followed speedily by the secretion, often in considerable abundance, of mucus, which is ropy or watery, irritating, and sometimes mixed with blood. It sometimes affects the lower bowel only, producing mild dysenteric symptoms; but frequently it commences in the upper bowel, or in the stomach, and spreading thence downwards gradually traverses the whole of the intestinal canal, causing in its progress more or less uneasiness, aching and griping, attended frequently with nausea and sickness while it is still high up, with diarrhœa and expulsive pains and efforts when it reaches the large intestine. [Woodward[1] remarks upon the limitation by a number of authors (following Broussais) of the term Enteritis to inflammation of the *small intestine*. The extension of the term, as it is applied in the present article, is much more in accordance with reason and expediency. Dr. T. K. Chambers has called attention to the frequency with which the stomach, duodenum, and liver are associated together in an acute disorder which he designates as "gastro-hepatic catarrh." What is popularly called "a bilious attack" is essentially of this nature.—H.] The tongue is generally more or less furred and dry, the breath offensive, and the appetite impaired; but these symptoms vary, and are often absent, especially when the large intestine alone is affected. Some degree of general febrile disturbance, indicated by heat and dryness of skin with sense of chilliness, increased frequency of pulse, lassitude and headache, is usually attendant on the local disorder. In children, in whom inflammatory affection of the gastro-intestinal mucous membrane is sometimes associated with aphtha, the disease not infrequently produces serious results and death, either from the debility which follows persistent diarrhœa and vomiting, or from the supervention of cerebral complications, such as convulsions or coma. There can be no doubt that a large number of cases of gastro-intestinal disturbance and of diarrhœa are due to catarrhal inflammation; yet the existence of such inflammation is more a matter of inference from symptoms than of direct observation upon the condition of the mucous membrane. For the latter can only be examined after death, at which time congestion and other indications of superficial and slight inflammation have for the most part disappeared, or are lost in post-mortem changes.

(*b*) *Croupous Inflammation.*—The designation "croupous" (diphtheritic or mem-

[1] See Dr. Fenwick on "The Condition of Stomach and Intestines in Scarlet Fever," Med.-Chir. Trans. vol. xlvii.

[1] Med. and Surg. History of the War, Part II. vol. i. p. 268.]

branous) inflammation is given to those cases in which the mucous surface becomes covered to a greater or less extent with a more or less adherent membranous film consisting of corpuscular elements cemented together by a coagulable exudation, and prolonged for the most part by rootlets from its under-surface into the Lieberkuhnian follicles. This affection, which is far from uncommon, may sometimes doubtless be regarded as the expression of some specific form of inflammation; certainly many believe (and I am one of them) that it is a common feature in the early stage of dysentery; at the same time it frequently occurs quite independently of all infectious or malarious influence. It undoubtedly indicates greater intensity of inflammation than mere catarrhal inflammation; there is generally much greater congestion and thickening of mucous membrane, and not infrequently hemorrhage, suppuration, or gangrene Croupous inflammation is often met with in the large intestine in scattered patches, which are sometimes linear, sometimes irregularly polygonal or stellate, and occupy for the most part the prominent ridges of the mucous membrane, more especially the edges of the intersaccular constrictions. In some cases, still chiefly occupying the more prominent parts, it forms a coarse, irregular network extending over large tracts of surface; in other cases it forms uniform patches of considerable extent. It is less common in the small intestines, but may be found in them affecting the free edges of the valvulæ conniventes, or spread over a large area. It is sometimes met with on the surface of tracts of cancerous infiltration which are on the eve of ulcerating. It may be added here that cases sometimes come under observation in which patients pass *per anum* shreds of false membrane, or even membranous casts of the bowel, of soft texture, various thickness, and of a dirty greenish or brownish hue. This discharge is generally, if not always, a consequence of dysenteric ulceration. The symptoms which attend croupous inflammation are not special; they vary, according to circumstances, on the one hand between those of diarrhœa and dysentery, and on the other hand between those of mere colic and of typical enteritis. The patchy form, indeed, so common in the large intestine, is often overlooked during life, from the fact that it occurs as a complication in the later stages of many grave disorders, as for example acute pneumonia, Bright's disease, cirrhosis of the liver, and cerebral affections. [There is no doubt at all that enteric inflammation is sometimes accompanied by a true pseudo-membranous exudation, almost if not quite always in cases whose symptoms are those of dysentery. But another group of cases also appear to be included in the statements just made; namely, those called by some authors tubular diarrhœa, muco-colitis, mucous disease, &c. In this affection there is no fibrin in the shreds or tubes passed from the bowel. As described by L. Beale,[1] they consist of "a very firm mucus, in which numerous cells of epithelium from the large intestine were imbedded." Dr. H. B. Hare, of Philadelphia, in some cases reported by Dr. Da Costa,[2] found casts composed "in the majority of instances, of mucus; one or two contained a trace of albumen;" but no fibrin. Dr. Woodward[3] asserts that they exhibit a hyaline or slightly granular matrix, which becomes fibrillated on the addition of acetic acid, from the precipitation of mucin filaments.—H.]

(c) *Chronic Inflammation and Degeneration.*—Both catarrhal and croupous inflammations, in their slighter degrees, generally, and for the most part speedily, undergo resolution. Sometimes, however, they end in ulceration; an event which, with its consequences, is fully considered further on. And sometimes they lead to persistent modifications of the mucous membrane which are often included in the term "chronic inflammation." These consist generally in slight condensation and hardening of the mucous tissue, more or less distinct congestion, or black pigmentary deposit in the villi and interfollicular spaces, some degree of atrophy of the Lieberkuhnian follicles, and granular or fatty degeneration of their epithelial contents, together with an analogous condition, more or less pronounced, of the epithelium of the mucous surface generally. The solitary and agminated glands are sometimes atrophied, sometimes larger and more obvious than natural. The changes indeed are chiefly changes of degeneration; and in that sense, as probably also clinically, are related to the lardaceous degeneration which occasionally happens in persons laboring under chronic tuberculosis, bone disease attended with suppuration, and secondary syphilis.[4] Lardaceous degeneration occurs later in the bowel than in the liver, spleen, and kidneys; it is found chiefly in the lower part of the ileum and

[1] Microscope in Pract. Medicine, 3d edition, p. 195.]

[2] Am. Journal of Med. Sciences, October, 1871, p. 321.]

[3] Med. and Surg. History of the War, Part. II. vol. i. p. 366. Dr. Woodward cites a number of other authors who have described this affection.—H.]

[4] See a good account of lardaceous degeneration, by M. Hayem, quoted in New Sydenham Society's Biennial Retrospect of Medicine and Surgery, for 1865–6, p. 176.

in the large intestine; it affects in the first instance the small arteries and capillaries around, and in the solitary and agminated glands, which bodies become swollen; and then gradually tends to involve the whole thickness of the intestinal wall, the muscular fibres and other tissues becoming finally infiltrated. The bowel thus becomes thickened, and at the same time harder than natural; and often in the later stages erosion of the affected glands occurs, leading in Peyer's patches to a reticulated condition of surface. The above chronic affections of the mucous membrane are generally associated with diseased conditions of other organs, to which indeed they are secondary; and not infrequently the stomach is at the same time the seat of some chronic morbid process. The presence of these complications, and the fact that clinically ulceration of the bowels, together with tubercular and other morbid processes, passes in a large number of cases for chronic inflammation, render it difficult to isolate the clinical phenomena due specially to the bowel affections now under consideration. They doubtless vary greatly; but may be briefly summarized as combining in various proportions, both relatively and positively, imperfect digestion of the alimentary matters received into the intestine, excessive secretion of more or less watery mucus, increased peristaltic movements with griping pains, looseness of bowels with discharge of watery, or yeasty, or otherwise unhealthy and offensive evacuations, and innutrition from the imperfect absorption of food.

III. As affecting the whole thickness of the Bowel.—By the older writers generally, and for the most part also by those of more recent times, the simple unqualified name "Enteritis" has been used to signify a special group of symptoms associated with the presence of a more or less extensive tract of intensely inflamed bowel. The affection here referred to is termed by Cullen phlegmonous enteritis, in contradistinction to the milder varieties of inflammation, affecting the mucous membrane only, which he included under the name of erythematous enteritis.

The symptoms which are supposed to characterize this form of enteritis may creep on insidiously or show themselves in sudden intensity, and consist mainly, in the earlier stages, in more or less severe abdominal pain (resembling in its character and in its increase by pressure and by movement the pain of peritonitis, but differing from it in being associated with colic), obstinate constipation, nausea and vomiting (occurring both after and independently of the ingestion of food), and marked febrile disturbance; and subsequently (supposing the case to be going on unfavorably) in the gradual supervention of tympanitis, attended, for the most part, with diminution or even total cessation of abdominal pain and tenderness, with still persistent constipation and vomiting (the vomited matters becoming opaque, brown, and fetid, if not actually fecal), with hiccough frequently, and with collapse (indicated by extreme feebleness of pulse, coldness and dampness of the surface, especially in the extremities), and finally death from asthenia. The morbid changes which may be looked for after death are such as are produced by intense inflammation of a limited tract of intestine. The affected part, which is mostly in the small intestine, and which may vary in length from an inch or two to one or two feet or more, is as a rule much dilated; its serous surface presents a general dusky red, or slate, or purplish-black color, due to the condition of the parts internal to it; it is marked, too, by lines or patches of more or less intense superficial congestion, may present blotches of sub-serous extravasation, and is often covered more or less with adherent lymph; its mucous and sub-mucous tissues are mostly somewhat thickened and softened, sometimes only moderately congested, but presenting spots and streaks of extravasation, sometimes black from combined congestion and extravasation, sometimes pale and infiltrated with lymph or pus, sometimes distinctly gangrenous; and its middle coat, sharing in these changes, is also more or less swollen and soft, and congested or œdematous, or the seat of some form of inflammatory exudation. The inflamed tract usually presents fairly well-defined limits, terminating abruptly below in pale and healthy but contracted and nearly empty bowel, above in bowel which may also be healthy, but is dilated like the diseased portion and filled like it with fecal contents. The diseased intestine contains frequently in addition to simple fecal matters more or less sanguineous exudation; and traces of the same exudation may often be discovered in the contracted bowel below.

Now, the above phenomena are by no means infrequently met with; they are the common accompaniments of strangulated hernia and of intussusception; they are present in those cases in which, as is supposed, the sigmoid flexure or some other loop of bowel becomes twisted on itself and thus strangulated; they supervene whenever a gall-stone or other foreign body of sufficient size becomes fixed in its passage along the intestine; they occur sometimes also as a late event in stricture, or in those cases in which the bowel becomes constricted by bands of lymph; they are sometimes developed as

a result of the extension of inflammation, either from peritoneum or from an intestinal ulcer; and very rarely indeed they originate idiopathically, that is to say from such general causes as produce idiopathic peritonitis, idiopathic pneumonia, and the like. Enteritis, therefore is a disease which is almost always complicated with some other grave lesion, on which indeed it depends, and which modifies alike its symptoms and its progress.

But even in the uncomplicated form of the disease, which is alone now under consideration, the symptoms are liable to considerable variety; the variations depending mainly on the degree of intensity of the inflammation and its extent, and on the situation of the affected portion of bowel. Indeed, the two principal factors in producing the characteristic symptoms of enteritis are inflammation, on which depend the various febrile phenomena, and paralysis of the inflamed portion of bowel, which permits of its passive dilatation by the accumulation of contents, opposes a more or less complete bar to their transit, and thus induces on the one hand constipation, on the other vomiting.

The most important practical distinction between colic and enteritis is, according to most authors, the absence of febrile symptoms in the former disease, their presence in the latter. And no doubt in most cases of enteritis febrile symptoms manifest themselves in a marked degree, at least in the earlier stages of the malady. Heat of skin, rigors, quickness and hardness of pulse, not infrequently mark the onset of the attack; but it is a mistake to suppose they are always present, or at all events readily perceptible, for in many cases no rigors are experienced, and in some there is little or no acceleration of pulse until towards the close of life, and no more heat of surface than may attend, and often does attend, the gripings of ordinary colic. There is mostly some dryness and clamminess of mouth, if not absolute thirst; and the tongue, which is occasionally pretty clean at the beginning, becomes generally soon thickly coated and ultimately dry. Another feature of enteritis upon which much reliance is placed is the association of the abdominal pain and tenderness of peritonitis with the tormina of colic. Pain and tenderness are certainly present in most cases, at least in the beginning, and in dependence upon them the dorsal decubitus, so characteristic of peritoneal inflammation. But these symptoms vary greatly; sometimes they are intensely severe, sometimes they are from first to last scarcely appreciable, and generally they subside in the progress of the case. It can readily be understood that when the peritoneal surface is largely involved, the pain and tenderness will generally be proportionably severe [see Perityphlitis, later in this volume.—H.]; that when an extensive length of bowel is affected, there will be correspondingly extensive uneasiness and tenderness; and that when, as sometimes happens, the serous surface is not inflamed, or when the affected portion of bowel is small, the pain and tenderness may be not only limited in extent, but no greater than one finds them in colic or in simple ulceration of the mucous membrane. It is worth while to remark, that limited pain and tenderness are very commonly referred to the region of the umbilicus. Tormina are often at the onset very agonizing, being then probably due in some measure to the spasmodic movements of the inflamed bowel; but they continue even after paralysis has become established, in consequence of the violent but ineffective efforts of the bowel above the seat of disease to overcome the impediment which the disease produces. But tormina are sometimes scarcely recognizable, and frequently like pain cease comparatively early. Constipation and vomiting are among the most essential symptoms of enteritis. In the uncomplicated affection the impediment to the action of the bowel is due simply to the presence of a paralyzed and inactive zone of greater or less breadth between an upper and a lower length of healthy bowel; it is no necessary part of the disease, therefore, that the outbreak of acute symptoms shall have been preceded by constipation, or even that after the disease has become established the portion of the bowel below the inflamed part shall not empty itself; and, it may be added, that in a variable degree the contents even of the inflamed gut may slip or be squeezed onwards into the healthy tube beyond, and that even calomel, and such other purgatives as act rather through the system than directly, may produce to some extent their characteristic effects. But it is nevertheless a fact that the inflamed bowel is really a substantial impediment, that there is therefore during the progress of the disease marked constipation, and that purgatives as a rule produce no purgative effect. Vomiting may occur in colic, in diarrhœa, in simple peritonitis, and in many other conditions as a mere sympathetic affection; and sympathy has probably some share in its production even in enteritis, at least at the commencement. But ultimately the vomiting here is due directly, like the constipation, to intestinal obstruction. In the first instance, no matter where the obstruction or what the immediate cause of vomiting, the vomited matters are merely the secretions of the stomach mixed with alimentary substances; but soon bile becomes mixed with these; and before long glairy mucus and bile alone are

discharged. Then the eructations become fetid; and soon the fluid brought up gets turbid and brownish, and by degrees comes to resemble the contents of the lower part of the small intestine, but it becomes fetid also, and sometimes much more fetid than the contents of a healthy bowel ever are, the fetor being caused partly by decomposition of the fecal matters, partly as in dysentery, by the discharges taking place from a gangrenous or otherwise diseased mucous surface. This vomiting of the contents of the intestines is, as Dr. Brinton has well explained, not due to inversion of peristaltic action; but is the result of the gradual accumulation of matters in the bowel above the seat of disease, of their mixture gradually effected by the normally directed peristaltic movements of the bowel, and of their escape into the stomach partly by simple overflow, induced sometimes by mere change of posture, partly by the pressure exerted on the distended bowel by the surrounding viscera, and by the muscular walls of the abdomen. The fetid matters which thus reach the stomach often, towards the close of life particularly, escape from it into the mouth by mere regurgitation. Tympanitis is probably in no case wholly wanting; in an early stage it may be, and perhaps usually is, absent or but little marked; ere long, however, the abdomen begins to enlarge, and generally as the case progresses becomes greatly distended, tense, and drum-like. This condition is of course mainly due to the distension by fecal contents and flatus of the portion of intestinal tube which is inflamed and of that which is above it, but now and then it is connected with rupture of the distended intestine and escape of gas into the peritoneal cavity—an accident, it need scarcely be said, of fatal augury. The pulse at the beginning is, as has been already remarked, often accelerated and hard, but it varies greatly in different cases, both in frequency, volume, and strength, and sometimes retains pretty nearly its ordinary healthy character throughout at least the earlier stages of the disease. As the fatal issue, however, approaches, it becomes more and more feeble, and sometimes at length wholly imperceptible at the wrist; it generally becomes then also quicker, sometimes slower, and not infrequently irregular. The temperature of the skin is usually in the first instance more or less elevated, and its surface dry; but even then perspirations are apt to break out, especially during the paroxysms of colicky pain: subsequently, however, the temperature falls, the extremities and face become cold and pale, or livid, with sometimes a faint tinge of jaundice, and all parts of the surface bathed in profuse cold perspiration. The expression of the patient is generally indicative of anxiety and distress, and it has often been noted that towards the close of life, the face becomes pinched and shrivelled and assumes an unnatural aspect of old age. He generally retains his senses throughout his illness, and even up to the moment of death; but this event is often preceded by a period of quiescence or lethargy, and occasionally by slight rambling and almost complete unconsciousness. It may be added here, that there is generally in enteritis more or less complete suppression of urine a phenomenon which has been variously interpreted, but which is probably due, as Mr. Sedgwick[1] argues, to the influence of the abdominal sympathetic system.

Enteritis, in that intense form of it which has been now described, is undoubtedly a very fatal, and indeed very rapidly fatal, malady. It is so difficult, however, practically to isolate the comparatively few cases in which it forms the primary and sole disease from the many in which it supervenes as a complication of some pre-existing graver lesion, that the former scarcely admit of statistical examination. As respects the duration, however, of fatal cases, it may be asserted that it rarely exceeds a week, and that it may be as short as twenty-four or thirty-six hours.

IV. Treatment.—It seems scarcely necessary to discuss here the treatment of simple catarrhal and croupous and chronic inflammation of the bowels; these inflammations, indeed, are so intimately connected, on the one hand with inflammatory conditions of the stomach, on the other with dysentery and diarrhœa, which have all been elsewhere described at length, that the reader may be safely referred to the articles relating to those diseases for the principles and details of treatment applicable to the inflammations now in question.

In reference to the treatment of the more severe forms of enteritis, two main principles seem now to be fairly well-established: they are, first, to relieve pain, and prevent, so far as may be, all movements of the bowels, by means of opium; secondly, to avoid every attempt (at least until all grave symptoms have ceased) to force the bowels by the administration of purgatives. It has been shown quite conclusively, principally by the experience derived from the after-treatment of strangulated hernia, that it is always dangerous to endeavor to propel fecal matters through an enteritic length of bowel, that in most cases the effort is useless so far as their effectual propulsion is concerned, while, by the augmented muscular and excretory action which is thus produced in the bowel above, the diseased tract below becomes more and more distended, almost certainly

[1] Med.-Chir. Trans. vol. li.

more and more softened, congested, and inflamed, not unfrequently becomes ruptured, and at the very least has its progress toward recovery delayed. Besides which, purgatives tend greatly to increase pain, and vomiting, and general distress. And, indeed, when one considers the great length of time during which constipation may continue with little or no influence on the general health, how long patients with impassable stricture of the bowel manage often to survive, it must be obvious that the constipation of a disease of so short duration as enteritis is not of itself a grave source of danger. Clearly, if the patient is to get well, his recovery must, in the first instance be dependent on the recovery by the diseased bowel of its healthy tone, and capability of peristaltic action: and to this end our efforts must be directed. But experience shows us that we have little or no power to arrest internal inflammation, unless it be indirectly by promoting the quiescence of parts, and by relieving pain and irritation; and, for these purposes, opium, in large and frequent doses, is generally our most valuable agent. No absolute rule can be laid down with regard to the quantity of opium which should be given for a dose, or to the frequency with which the dose should be repeated; the patient should, however, be got well under the influence of the drug, and should be kept under its influence. But the constant vomiting and the distension of the bowels above the seat of disease, form a serious, if not fatal, impediment to the absorption of opium received into the stomach; what is swallowed may be wholly vomited, or, if retained, very partially or not at all received into the system. If therefore it be thought right to administer opium by the mouth, it should be given in the form least liable to provoke, or to be rejected by, vomiting; but it is certainly best to administer it in the form of suppository or enema, or to inject it subcutaneously. But, no doubt, it is generally desirable, and even necessary, to associate with the use of opium other details of treatment. The question of the abstraction of blood, formerly so largely employed in the treatment of internal inflammations, is not unlikely to arise, and it must be acknowledged there are cases in the early stage of which removal of blood may be advantageous. When, at the commencement of enteritis, the symptoms of peritoneal inflammation are strongly pronounced, there is no doubt that the application of twenty, thirty, or more leeches to the surface of the abdomen is generally followed by great and immediate relief, if not by actual benefit. Doubtless, the removal of blood from the arm would be at least equally beneficial; and in cases in which, at the same stage, peritonitic symptoms are less distinct, but in which there is high fever, I should not hesitate to have phlebotomy performed. Warm but light applications to the surface of the belly generally soothe, even if they produce no further beneficial effect; and sometimes mustard plasters, and similar mild counter-irritants, give relief. In the same way, enemata of warm water or of warm gruel are at times useful. There are few symptoms more distressing to the patient than the persistent nausea and vomiting from which he suffers, and few therefore which we feel more anxious to relieve; but there are none which, at all events at certain stages of the disease, are less under the influence of direct treatment. At any early period, when these symptoms are merely sympathetic, ice, hydrocyanic acid, alkalies, lime-water, bismuth, carminatives, and other remedial agents, may no doubt restrain them to some extent; and again, when the disease has begun to take a favorable course, they subside naturally, without any special treatment; but when the vomiting is simply the result of over-distension of the stomach and bowels, to which over-distension there is no other channel of relief, medicine ceases to have any power over it. The extreme prostration which so early manifests itself, is a strong indication of the need of food and stimulants; but how can they be administered with even a chance of benefit? Their exhibition by the mouth tends to promote sickness, tends also to add to the distension of the already too much distended stomach and bowels, while probably, from various causes, little or nothing of them becomes absorbed. It is obvious, indeed, as is insisted on by Dr. Brinton,[1] that alimentary matters, if given by the mouth, should only be given in very small quantities, and in a form suitable for their ready appropriation by the system. They may, however, be given in much larger quantities, and with none of the above ill effects, and also with a much greater chance of benefit, in the form of enemata. It is not intended by the above remarks to discourage all attempts to restrain sickness, or to supply stimulants or food, for there are cases which seem hopeless, in which, nevertheless, the bowel is recovering, and in which the alternative of life or death depends upon the judicious use of remedies and of regimen; but only to discourage persistence in lines of treatment when their effect on the patient, and the progress of the case, prove their inutility or harmfulness. [The external application of ice has lately been advised by a few medical writers. Its use will certainly require extreme caution, that it shall not be overdone. More safe, and often beneficial, is the administration of ice in small quantities, frequently taken, by the mouth.—H.]

[1] Intestinal Obstruction. 1867.

OBSTRUCTION OF THE BOWELS.

By John Syer Bristowe, M.D., F.R.C.P.

The affections which are here to be treated of present many features in common with entiritis, and their description is not infrequently included in the description of that disease. Actual enteritis does indeed occur at some period or another in the course of most of them; but their special claim to form a group by themselves consists in the fact of the existence in all of them of some mechanical impediment to the transmission of the contents of the bowels, in connection with which enteritis is apt to, but does not in all cases necessarily, supervene. They are: 1st, constipation; 2d, stricture; 3d, compression and traction of the bowel; 4th, strangulation; 5th, impaction of foreign bodies; and 6th, intussusception.

I. Constipation.

(*a*) *Pathology and Symptoms.*—Constipation not only forms a more or less essential element in the history of all the affections just enumerated, but of itself induces occasionally insuperable obstruction; and on both of these grounds demands some brief consideration here. Prolonged retention of feces is, within certain limits, of such common occurrence, and is attended with so little inconvenience, that it scarcely deserves in a large number of cases to be regarded as an abnormal condition. It may doubtless be accepted as a general rule, that persons enjoying robust health, and unimpeded in the regular performance of their various functions, have an alvine evacuation at least once daily. Yet many who are apparently equally healthy have their bowels relieved habitually every two or three days only, or even but once in a week or fortnight. Cases indeed are not altogether rare in which some degree of good health has been maintained for many years although fecal evacuations have during that time occurred only at intervals of six weeks or two months. In the case of a lady recorded by Dr. Robert Williams,[1] in whom habitual constipation appears to have been augmented by the constant use of large quantities of opium, the bowels were frequently confined for six weeks together, and during one year of her life there were only four evacuations at intervals of three months. It must not be forgotten, however, that that degree of constipation which is habitual with one man, and in him compatible with perfect health, may be and often is, a source of discomfort, if not of positive illness, to another man in whom its occurrence is exceptional. Thus, to most persons whose daily habits in this respect are regular, the retention of feces for two or three days is apt to produce not only local uneasiness, such as fulness, heat, tendency to piles and flatulence, but also some degree of general constitutional disturbance indicated by headache, foul breath, loss of appetite, and dyspeptic symptoms, and not infrequently terminates with more or less tenesmus, or even slight dysenteric diarrhœa. But even in cases in which, from long habit, constipation has come to be regarded as the normal condition of things, some of the above specified discomforts do actually for the most part coexist in some degree with it, but having become, like the constipation, habitual, cease to be observed, or at all events become tolerable. It is easy indeed to see that constipation must tend to produce various inconvenient results: the retention of a mass from which gaseous matters are being constantly evolved, is necessarily productive of colicky pains and imperative desire to discharge flatus; the constant pressure of a hard mass immediately above the anal outlet causes not only congestion of the mucous membrane of the part, but retardation of blood in the hemorrhoidal veins, and ultimately piles,—it produces also not infrequently some degree of uneasiness in connection with the genito-urinary organs; lastly, when defecation occurs, the expulsion of the feces is apt, in consequence of their bulk and hardness and dryness, not only to be attended with very considerable pain, and perhaps some loss of blood, but to be followed by prolonged burning or aching, and (as has been already pointed out) by more or less dysenteric inflammation.

But much-prolonged constipation leads sometimes to other and far more serious results, namely, to dilatation and hypertrophy of the intestine, ulceration of its

[1] Dr. Burne on Habitual Constipation, quoted by Mr. Pollock in Holmes's "System of Surgery," vol. iv.

mucous surface, and perforation of its walls with extravasation of fecal matters into the peritoneal cavity. The dilatation is sometimes so great, that the colon measures from nine to ten or even twelve inches in circumference. It begins at a distance of one or two inches from the anus (which seems spasmodically contracted) and occupies more or less of the remainder, sometimes the whole length of the large intestine; in which latter case the chief distension is observed in the rectum, sigmoid flexure, and cæcum. Hypertrophy of the muscular coat, which always accompanies dilatation, is general, but most marked in the sigmoid flexure and upper part of the rectum, where the thickness may be ½ inch or more. When ulceration takes place, it is perhaps partly due to yielding of the mucous membrane from over-distension, partly to the constant irritation kept up by the fecal mass within. Perforation may ensue, either while the constipation remains unrelieved, and then either through the progress of ulceration or by laceration; or after the bowel has been emptied, in consequence of the continuance of ulceration. Enormous quantities of fecal matter are sometimes removed from patients suffering from aggravated constipation; in Dr. Williams's case above referred to, numerous round lumps, each the size of a large fœtal head, were passed at a time, and often in sufficient numbers to fill a common-sized pail.

I recollect two fatal cases which strikingly illustrate some of the observations which have just been made. The first was that of a little girl, eight years old, whom I saw casually only during life, and of whose history I obtained after her death some not very perfect details. She had long suffered from tendency to constipation; and it was stated that she had occasionally gone as long as three weeks without passing an evacuation. At the time of her admission into the hospital there had been no relief of the bowels for seven weeks. She was then pale and thin, had a large tense belly, without pain or tenderness, a clean tongue, and a poor appetite. She had a "strumous" look, and was supposed, I believe, to be suffering from abdominal tubercle. She became gradually more and more emaciated and anxious-looking, while the belly grew larger and more tense. She never had any distinct abdominal tenderness, but suffered at times from colicky pains, and often (especially towards the close of life) complained that she was so full that she felt as if she should burst. During the last week or two the tongue became somewhat foul, and she had frequent vomiting, but never of stercoraceous matter. She passed but little urine, and that was high-colored. She sank gradually from exhaustion, and died exactly three weeks after admission. Amongst other kinds of treatment adopted was the use of purgative medicines and of purgative injections; and the medical man in attendance on her was led to believe that they had acted. There is no doubt, however, from subsequent inquiries, as well as from what was observed after death, that he was deceived. At the post-mortem examination, the form of the distended intestines was distinctly impressed on the tense and thin abdominal walls, and on opening the abdomen the enormously enlarged colon was at first alone visible. The distension began at the cæcum and extended to within two inches of the anus, where it ceased abruptly. In the greater part of its extent, the bowel measured from nine to ten and a half inches in circumference, the greatest amount of distension being manifested in the sigmoid flexure. The muscular walls were hypertrophied from the ascending colon to the lower end of the sigmoid flexure; and in the latter situation (where the hypertrophy was greatest) they measured ½ inch in thickness. The mucous membrane seemed healthy in the greater part of its extent, but it presented some congestion here and there, and at distant intervals large patches in which there were groups of small circular shallow ulcers. The bowel contained no flatus, but was completely full of thick, semi-solid, olive-green-colored feces. These were more solid in the rectum than elsewhere, and immediately above the anus formed an indurated conical lump. The small intestines were also considerably distended, though much less so than the larger bowel, and were filled throughout with semi-fluid olive-green-colored contents. The stomach was small and healthy and empty. There was no other disease. There can be no doubt that the death of the child was due to the neglect of simple constipation, that the indurated fecal lump above the anal orifice had formed a plug which the bowel had been unable to expel, and which the accumulation of more and more feces above and around it had served only to fix more securely. That the bowel had striven to expel its contents was shown by the hypertrophied condition of its muscular coat. A very similar case is recorded by Mr. Gay;[1] but there the nature of the case was recognized, the rectum was relieved by mechanical means, and the child was saved. The second case referred to above was that of a young man, aged 24, who also had been the subject of habitual constipation; and who on one occasion, after the persistence of constipation for an unusually long period, was attacked with diarrhœa, which lasted

[1] Path. Soc. Trans. vol. v.

about six weeks, and was then followed by sudden peritonitis, of which he died. There was found after death inflammation of the peritoneum, due to a perforation in the transverse colon, great dilatation and thickening, yet almost complete emptiness of the whole length of the large intestine, and just the same kind of ulceration of the mucous membrane in patches as that described above. It was in one of these patches that perforation had taken place. Here, as in the former case, it is obvious that long-continued constipation had caused permanent thickening and dilatation of the large intestine, and ulceration of its mucous surface; but here, additionally, after the relief of the constipation, the ulceration had provoked and maintained a condition of diarrhœa, and ultimately caused perforation.

Constipation, in the sense in which the word is here employed, is probably always due to retention of feces in the lower part of the large intestine, either from failure to respond to the desire for defecation when the desire presents itself, or from sluggish action on the part of the lower bowel. It is very rare indeed, if there be no actual obstruction, that the contents of the alimentary canal do not pass along the whole length of the small intestine, and even along the colon, at a tolerably uniform rate; at all events, any actual arrest of their transmission, unless it be owing to the presence amongst them of some massive foreign body, is probably never met with except occasionally in the cæcum and sigmoid flexure.

Constipation is due to a variety of causes, and occurs under numerous different conditions, which it is scarcely necessary to enumerate here, far less to consider in detail. It is frequently caused temporarily by change of diet, scene, or habits, among which latter may be included anything which interferes with the regular performance of defecation; it happens commonly in various kinds of disease, and it occurs in a chronic form in chlorotic or dyspeptic girls and young women, and also in men and women (especially the latter) of sedentary habits or of sluggish constitution. It occurs, too, often perhaps as the result of habit, in persons, young and old, in whom no special cause for it can be recognized; and indeed, in many of the more remarkable cases that come under observation, it is quite impossible to assign a definite cause for it. Among local conditions which may be supposed to operate in a greater or less degree in the above cases, are: first, modifications in the character of the feces such as we see in diabetes, where, owing to the rapid escape of fluid by the kidneys, they become preternaturally dry, and proportionately diminished in bulk; second, sluggishness on the part of the rectum; and third, debility of the same part which may be primary, and due in the first instance to simple thinning and weakening of the muscular fibres, and which probably occurs virtually in all cases of long-continued constipation, when the bowel has become dilated, and on that account (even if the muscular coat be hypertrophied) less competent to contract efficiently on its contents.

(*b*) *The Treatment* of constipation must be made to depend more or less upon its cause, on its antecedents, and on its effects. Where it is a mere temporary matter, depending on accidental circumstances, or arising in the course of acute diseases, its treatment is simple enough, and needs no description here. When it has become a chronic affection, its causes should be investigated, and as far as possible obviated; and it may be necessary to employ habitually mild aloetic or other purgatives, or enemata. Sometimes the application of galvanism to the surface of the abdomen, or to the abdomen and anus, is efficacious. But iron and other tonics also are frequently of advantage; and strychnia is by many believed to be of great value. [Hyoscyamus and belladonna, added to laxative pills, often do good.—H.] In cases in which the rectum becomes filled with a hard immovable mass, and the bowel above distended in consequence with accumulated contents, the evacuation of the rectum by mechanical means becomes essential. This may be effected sometimes by the use of the finger or of a spoon, or some such instrument; sometimes by the employment of copious enemata administered in the ordinary way; or, better still (as in Mr. Gay's case), by directing a forcible stream of warm water, conducted from a height by means of a tube, into the rectum, allowing it to play upon the fecal mass for half an hour or so at a time, and thus to cause its disintegration, and either effect or facilitate its removal.

II. Stricture.

By this term is meant a circumscribed diminution in the calibre of the bowel, due either to contraction of the mucous and sub-mucous tissues (the consequence usually of ulceration), or to some deposit or growth involving the general thickness of the walls and encroaching on the canal, or to some spasmodic action of the circular muscular fibres. It is occasionally the result of malformation.

(*a*) *Pathology.*—Congenital stricture, though in some of its forms by no means rare, is an affection the treatment of which belongs almost exclusively to the surgeon, and one, therefore, that needs little more than incidental mention here.

It is limited, indeed, with few exceptions, to the lower extremity of the bowel —the rectum and the anus—one or both of which parts may be found at birth to be impervious or absent, or reduced to a mere fistulous canal or orifice, while, in addition, the lower end of the fully-dilated bowel above occasionally communicates with the vagina in the female, or with the bladder or urethra in the male. Very much more rarely, congenital stricture is met with in the duodenum, at or above the point at which the common bile duct discharges itself. Two cases of this kind are recorded in the twelfth volume of the "Pathological Society's Transactions," one by Dr. Wilks, the other by Dr. G. Buchanan. In both, a kind of membranous septum existed at the point referred to, and the portion of the duodenum above was thickened and dilated, forming a mere prolongation of the pyloric end of the stomach. In Dr. Wilks's case the bile duct opened immediately below the septum, which was impervious; and the child died at the end of thirty-eight hours, its death being preceded by vomiting and convulsions. In Dr. Buchanan's case, the duct opened on the under-surface of the septum, the septum presented a minute central orifice, and the child, a girl, lived eighteen months. According to the history, she was apparently quite well up to within a month of her death, probably because (as is supposed) she had hitherto been fed only from the breast and with milk. She appears during the last month of life to have suffered from constant vomiting, great restlessness and uneasiness or pain, together with (during the earlier part of that time) frequent convulsions. It may be added, that in this case, where the parts were examined with much minuteness, the septum was ascertained to consist of a duplicature of mucous membrane, not unlike an enlarged valvula connivens, inclosing a few scattered muscular fibres prolonged from a stout circular band which surrounded its base.

Although spasm of the circular muscular fibres has been given above as one of the causes of intestinal stricture, and although it doubtless does form a very important element in many cases of fatal obstruction of the bowels, it is certainly of very rare occurrence, as an independent affection, and may be considered practically as limited to the rectum and anus. And indeed, even in these parts, spasmodic obstruction is probably always attended with some ulceration of the adjacent mucous membrane, to which there is reason to believe it secondary. Thus spasmodic contraction of the sphincter ani, an affection which may be regarded as exclusively surgical, seems to be dependent on the formation of an ulcer, at or within the verge of the anus; and not very infrequently spasmodic contraction, with great hypertrophy of the muscular tissue, is met with as one of the troublesome sequelæ of dysenteric ulceration of the rectum.

But the varieties of stricture with which we have here to deal particularly, are those in which, according to the definition with which we started, the stricture is due either to the contraction of the mucous and submucous tissues, or to some deposit or growth involving the general thickness of the walls. The cicatrization which follows ulcerative destruction of the mucous membrane is a common cause of diminution of the calibre of the bowel. But what particular kinds of ulceration are most apt to be followed by this condition is not very clear. Indeed, in most cases where stricture from ulceration is found after death, there is nothing in the history to guide our judgment in this respect. It is certain, however, that in order to produce any marked constriction, the area of ulceration must either have been considerable, or must have extended round the bowel. There is reason to believe that irritant poisons, in consequence of their corrosive effects on the mucous membrane, lead occasionally to the production of stricture of the intestine, especially in its upper part, just as they occasionally cause œsophageal stricture. There is no doubt that tubercular ulceration of the bowels, which very commonly forms annular patches or occupies extensive tracts, and which not at all infrequently undergoes more or less perfect cicatrization, is a yet more frequent cause of stricture, either in the lower part of the ileum, or in the cæcum, or in some part of the colon. Dysenteric ulceration of the large intestine is also a distinct cause of stricture; as again is the separation by sloughing of an invaginated portion of bowel. The ulcers of typhoid fever, on the other hand, are known to result very rarely, if ever, in obvious contraction of the calibre of the bowel: although it is pretty certain that even in this case, when the ulceration has spread and become extensive, marked constriction may attend its cicatrization. When stricture is due to ulceration, we find the mucous surface contracted, sometimes completely cicatrized, sometimes presenting unhealed spots of ulceration, with fungous excrescence or granulations, and separated from the subjacent muscular coat by a more or less abundant deposit of dense fibroid tissue. The stricture itself may be a mere ring, or it may occupy several inches of the length of the bowel; I have seen the whole cæcum thus reduced into a channel barely capable of admitting a goose's quill. Another cause of stricture, limited probably to the large intestine, is

the growth of that fibroid material which resembles, but has of late been distinguished from, true scirrhus. This generally involves all the coats to a greater or less extent, encroaching, as it grows, upon the intestinal tube. Sometimes, but not necessarily, its surface ulcerates. A growth probably identical with this, occurring in so-called "pelvic cellulitis," sometimes involves the walls of the rectum and causes stricture there. But by far the most frequent cause of stricture is the development of cancerous disease in the coats of the intestine. This is sometimes local, or at all events of primary origin in the bowel, being then, perhaps without exception, a disease of the large intestine; but more frequently it involves the gut by spreading to it from some neighboring part, as from the peritoneum, the mesenteric or other abdominal lymphatic glands, from the substance of the gastro-hepatic omentum, from the cellular tissue of the venter ilei or pelvis, or from the genito-urinary organs.

The presence of a stricture is always a more or less serious impediment to the progress of fecal matters along the bowel; and in all cases therefore leads in a greater or less degree to certain results. These are: first, undue accumulation of fecal matter above the stricture, with proportionate dilatation of the bowel there; second, hypertrophy of the muscular parietes of the dilated bowel; and third, diminution in calibre and even atrophy of the bowel below. It is an interesting fact that, in cases of stricture of the colon, the greatest degree of dilatation is often found, not in the portion of intestine immediately above the stricture, but in the cæcum. The tighter and the longer a stricture, the more exaggerated, other things being equal, will be the several consequences just described; and the more danger will there be of the supervention of permanent obstruction. Yet it is a very remarkable fact, that very tight strictures are not infrequently found after death in cases in which during life there has been no suspicion of their presence. Allusion has been already made to a case which was under my own care, wherein the cæcum was contracted into a channel two inches long, and about the size of a goose's quill; yet the patient had no symptoms of stricture, and died of acute pneumonia. But it is in the small intestine especially that stricture is apt to be present without producing any of its characteristic symptoms—a phenomenon which is probably due, in part, at least, to the fact that the contents of the small intestine are usually much more fluid than those of the large, and are consequently much more readily propelled through a very narrow orifice. Indeed, Dr. Buchanan's case already cited, and many others that might be quoted, show clearly, what also common sense would lead us to surmise, that the more solid the matters are which ought to be forced through a stricture, the more likely are they to be arrested there, and thus to render the obstruction complete. It may be added, that the lodgment of feces above a stricture is very apt, not only to prevent the complete cicatrization of the ulcer by which the stricture itself may have been originally produced, but to cause erosion and ulceration in the dilated bowel above, a contingency which is still more likely to arise when cherry-stones or plum-stones or other hard bodies form a part of the accumulation. And, further, it may be added, that perforation of the bowel at or above the seat of stricture is not of very infrequent occurrence, generally as the result of perforating ulcer, occasionally as the result of laceration from associated softening and over-distension.

Stricture may be met with in any part of the intestine, yet it occurs in different parts with very different degrees of frequency. The published statistics of fatal cases show that its occurrence as a fatal disease in the small intestine is comparatively rare (according to Dr. Brinton,[1] in 8 out of every 100 cases), and that as regards the large intestine (to quote again Dr. Brinton's figures, with which those of other writers agree pretty closely), out of 100 fatal cases, 4 are in the cæcum, 10 in the ascending colon, 11 in the transverse colon, 14 in the descending colon, 30 in the sigmoid flexure, and 30 in the rectum. Dr. Brinton calculates that stricture occurs three times in men to twice in women; and that the average age at death is $44\frac{2}{5}$ years.

(*b*) *The Symptoms* to which stricture gives rise vary greatly according to circumstances, especially according to its position, its degree, its cause, and its complications. As has been already pointed out, stricture of the small intestine very rarely causes symptoms sufficiently characteristic to enable us to diagnose its presence, and rarely causes death except by the accession of complications which themselves are not distinctive. It probably gives a liability to colicky pains, and to some degree of nausea and sickness. Indeed, in the case of the large intestine the symptoms produced by stricture may be for a long time vague and inconclusive, and even misleading. The patient suffers perhaps for weeks, or months, or years, with occasional attacks of colicky pain, associated, it may be, with more or less constipation;

[1] "Intestinal Obstruction," by William Brinton, M.D., F.R.S. 1867. Frequent reference is made to this work throughout the present article.

but not infrequently during the earlier period of his malady diarrhœa may be a yet more prominent symptom. If, however, the obstruction be in the vicinity of the rectum, solid motions generally soon assume a narrow tape-like or pipe-like form. Occasionally the symptoms of obstruction come on quite suddenly; but most frequently some degree of constipation long precedes the occurrence of complete obstruction; and sometimes, too, it happens that the patient, previous to his final attack, may have experienced one or two or more similar attacks, which have, however, yielded to treatment. The symptoms which attend and indicate impassable stricture are insuperable constipation, painful peristalsis coming on periodically, and often rendering itself audible by borborygmi, and visible through the abdominal walls, abdominal fulness and uneasiness, followed after a time by nausea and vomiting—the vomited matters becoming finally stercoraceous—and death at last from simple asthenia. Febrile symptoms and abdominal tenderness are often absent from first to last: but sometimes inflammation supervenes, or perforation takes place, and then enteritic or peritonitic symptoms become superadded. When the case is free from these or other complications, its progress is essentially chronic, and the patient, if not improperly treated, lives for a considerable time, often for many weeks. The duration of life in these cases may be said somewhat roughly to vary between two weeks and three months. Indeed, when we consider that constipation may continue for three months or more with comparatively little injury to the system, it is impossible not to believe that persons with simple impassable stricture of the rectum may, under favorable circumstances, survive for even a longer period than that.

It is always satisfactory, and sometimes highly important, to ascertain the exact site of stricture; and in coming to a conclusion on this point, it is well to bear in mind that at least three-fourths of the strictures of the large intestine are situated to the left of the mesial line of the abdomen. We need not, however, in all cases limit ourselves to a simple calculation of chances. It is natural to believe that the distension of the bowel above the stricture, and its collapse below, should reveal themselves to manual if not to ocular examination of the abdomen, and sometimes, no doubt, the form and position of a struggling, or even of a quiescent, length of distended bowel, may by such means be clearly identified. Fulness and dulness and weight in the course of the cæcum and ascending colon, or on the right side of the belly, might thus indicate a stricture at or about the hepatic flexure, and, associated with the same conditions extending across the epigastrium, might indicate stricture at the splenic flexure or in the descending colon; whereas fulness, and the like, limited to the left side of the belly, or most pronounced in that region, might equally be indicative of stricture in the sigmoid flexure or rectum. But thickness or rigidity of the abdominal walls, or tenderness, or the presence of tumors, or the altered positions which greatly distended tracts of bowel are apt to assume, often interfere to prevent the easy recognition of even extreme differences of intestinal dilatation and fulness. Dr. Brinton maintains that the amount of fluid which may with care be injected *per anum*, is a very valuable guide in estimating the point of stricture. He says: "With a maximum injection of a pint of warm bland liquid, the obstruction of an ordinary male adult may be referred to a point not lower than the upper end of the rectum. A pint and a half, two pints, three pints, belong to corresponding segments of the sigmoid flexure. The descending and transverse colon accept a larger but more irregular quantity." But here again there is evidently very abundant room for error; for it is certain that not all contracted bowels are tolerant in an equal degree of mechanical distension, and there can be no doubt that a stricture, which may prevent the passage of hard fecal matter in one direction, may yet allow of the transmission of thin fluids in the opposite direction. Lastly, when the stricture is a short distance only from the anus, its presence may often be ascertained by the introduction of the finger, or, as has been suggested, of the entire hand; and if it be beyond the reach of actual touch, yet in the rectum, the careful introduction of a bougie may perhaps reveal its position. But it must not be forgotten that the curvatures of the rectum, and the prominent folds of its mucous membrane, are such impediments to this latter mode of examination as to rob it of very much of its value; in addition to which, it is attended with, at all events in many cases, considerable risk of damage.

(c) *Treatment.*—Whenever we have reason to believe in the presence of a stricture, it is obviously desirable that nothing which is not in a perfectly fluid or pultaceous condition should be allowed to enter the bowel,—therefore, that the food taken habitually should be easy of digestion, thoroughly well masticated, and not more abundant than is absolutely necessary for the preservation of health, and especially that neither plum nor cherry stones, not even pips, should be swallowed: secondly, that the bowels should themselves be kept as far as possible in a quiet condition—in other words, whilst constipation should as far as pos-

sible be prevented, diarrhœa and painful gripings should equally be guarded against. If there be constipation, it may be directly relieved, or the bowel above the seat of stricture may be encouraged, as it were, to propel its contents by the use of simple non-purgative enemata; but purgatives of all kinds, certainly anything like active purgation, should be religiously eschewed. Should the stricture be in the rectum, and within reach, it may of course admit of dilatation and relief by the use of a bougie. When symptoms indicative of complete stoppage manifest themselves, the wish to employ active measures to relieve the patient's distress naturally obtrudes itself; but such measures are for the most part even less admissible now than formerly. Enemata may be of advantage, partly, as before pointed out, to guide our judgment as to the seat of the stricture, partly (if the stricture be in the large intestine) for the purpose of promoting the relief of the bowel above the impediment; but purgatives are not only useless, but almost certain to do serious mischief, if not to cause actual perforation. On opium and other sedatives, and soothing applications locally applied, utterly inadequate though they generally are, must yet be our chief reliance, so far as ordinary medical treatment is concerned. But in all such cases a time comes when the advisability of forming a communication from without with the portion of bowel above the stricture—in other words the attempt to establish an artificial anus—becomes a serious question. When the stricture is in the large intestine, as it generally is, Amussat's operation, in one or other loin, is that which would of course be chosen for performance; and although it is obviously incompetent to cure the stricture, it avails very often to prolong life, and sometimes to prolong it for a considerable period. If the stricture happens to be in the small intestine, Littré's operation is alone available.

[Littré's original operation was, making an opening in the sigmoid flexure of the colon in the left iliac region.[1] Since, however, he was the first to suggest (1710) opening the abdominal walls in order to give relief to obstructed bowels, the operation of *enterotomy*, in which the small intestine is made the seat of an artificial anus, is often designated by his name. According to Bryant,[2] the first opening into the small intestine in the right groin, the operation now most frequently practised, was made by Nélaton, about twenty-five years ago.

Amussat's operation (a modification of Callisen's) consists of a transverse incision through the skin and muscles of the lumbar region, into the colon; lumbar colotomy. Amussat preferred operating upon the right lumbar region; but many surgeons follow Callisen in choosing the left lumbar region. Jonathan Hutchinson[1] still prefers the right side for lumbar colotomy.

Dilatation of a strictured rectum with bougies, or with elastic dilators filled with air or water, simple as it seems, is not devoid of danger. When the bowel is ulcerated, the use of much force may cause its rupture; sometimes with serious hemorrhage, and in other cases with cellulitis, peritonitis, and death.

Treatment of stricture of the bowel in a manner similar to that employed for the cure of stricture of the urethra, namely, by incision and subsequent moderate dilatation, has much argument in its favor. Several surgeons have *nicked* the strictured part; but free incision appears to have been seldom practised. Dr. F. Lente,[2] of New York, has performed this operation successfully, and advocates its repetition; the incision being made by him both anteriorly and posteriorly, exactly *in the median line*, and with precautions against hemorrhage. Verneuil also has performed and advised the same operation in certain cases of stricture of the rectum.[3] His incision, however, is posterior only; which, no doubt, is attended by the smallest danger.—H.]

III. Compression and Traction.

Dr. Hilton Fagge[4] has with great reason distinguished on the one hand from stricture, on the other from internal strangulation, a class of cases related to both, which is yet clearly distinguishable from them, and which he designates "Contractions." They are cases in which the bowel becomes obstructed by the compression, or the pressure, or the traction exerted upon it by adhesions, or growths, or deposits situated externally to it, and in which there is no contraction inherent in the walls themselves, and not necessarily or generally any strangulation.

(*a*) *Pathology.*—Under the above heading may be included those cases in which the return becomes obstructed, and defecation rendered painful or difficult, in consequence of the pressure exerted on

[1 See Mason, Am. Journal of Med. Sciences, October, 1873, p. 362.]

[2 Surgery, Amer. edition, p. 450.]

[1 Brit. Med. Journal, Aug. 31, 1878.]

[2 Am. Journal of Med. Sciences, July, 1873, p. 23.]

[3 Gazette Médicale de Paris, Jan. 4, 1873.]

4 In an excellent paper in the Guy's Hospital Reports for 1869, to which frequent reference is made in the course of this article.

that part of the bowel, either by an enlarged or displaced uterus, or by a uterine or ovarian tumor. It is conceivable, of course, that any form of abdominal tumor may by pressure obstruct the alimentary canal in some part of its course. I recollect one case of death by rupture of the abdominal aorta, in which the blood, effused and coagulated in the sub-peritoneal tissue, had so surrounded and compressed the third part of the duodenum that the finger passed along it with difficulty; and while the stomach and duodenum above contained a considerable quantity of contents, the intestine below was perfectly empty.

But the cases which are now more particularly referred to are those in which obstruction is due to the embarrassment of a greater or less length of bowel, caused by the presence on its outer surface of lymph or false membrane, which binds it more or less firmly to the surrounding parts, and sometimes constricts, sometimes leads to the formation of sharp angular bends. The adhesions are often produced by circumscribed peritonitis, but more frequently, perhaps, are developed in the course of peritoneal tubercle or cancer. In some cases the intestine has been incarcerated in a hernia, and portions of it have become invested in adhesions, which attach it, perhaps, to the neck or some other part of the sac, or to the omentum; in others, the transverse colon or sigmoid flexure, or some other tract of bowel, is hooked down, as it were, by bands of lymph to the uterus, or ovary, or some other structure within the pelvis; in others, again, several contiguous coils of small intestine are tightly bound together, forming a kind of tangled mass. Fatal cases of compression or traction always furnish distinct evidence of more or less complete obstruction, in the contraction and emptiness of the bowel below, and in the dilatation, hypertrophy, and fulness of the bowel above; but the part in which the actual obstruction has taken place, though contracted and more or less empty, is frequently found to admit with ease of the passage of the finger, or even of some larger body. The immediate cause of obstruction, indeed, is not generally a simple tight constriction, but consists sometimes in a comparatively slight compression of a considerable length of bowel, which thus becomes embarrassed in its action, and sometimes in the presence of a sudden bend or twist, the upper portion of which becoming distended presses upon and flattens the portion beyond, and so renders it impervious, and in association with these doubtless a greater or less degree of spasmodic contraction. Sometimes, however, the obstruction is as sharp and definite as any stricture.

Dr. Fagge points out (and in the opinion which he expresses I entirely agree with him) that these cases are of far more frequent occurrence in the small intestine than in the large, and that in a clinical point of view they may be regarded as the strictures of the smaller bowel.

(*b*) *Symptoms and Treatment.* — The symptoms of the affection now under consideration are almost, if not quite, identical with those of stricture. In both cases, when the impediment to the due action of the bowel is associated with abdominal cancer or tubercle, or any other form of adventitious growth, the symptoms connected with these complications mask, if they do not conceal, the symptoms due to obstruction. In both cases, when no such complications are present, the symptoms sometimes come on quite suddenly, sometimes creep on insidiously with occasional colicky pains, limited but powerful peristaltic movements, and gradually increasing obstinacy of the bowels; and sometimes the patient suffers from one or more severe attacks of total constipation, which yield after a time to nature or to treatment, and in this respect only differ from the final and fatal attack. In both cases, again, the disease, though not entirely free from the danger of the supervention of peritonitis or enteritis, is still not necessarily complicated with symptoms of inflammation, and its course, therefore, tends to be peculiarly chronic, lasting sometimes for weeks, and its close is usually determined by gradual exhaustion only. Dr. Fagge thinks that cases of this kind are to be distinguished by their chronicity, by the occurrence of obstruction rather in the small intestine than in the large, and by the powerful and well-marked vermicular movements which occur, often nearly to the last, in the length of bowel above the impediment. He points out that it is in cases of chronic impediment especially that the bowel above becomes hypertrophied as well as dilated, and he argues that it is therefore probably in these same cases (stricture and compression) that the movements of the bowel, in their endeavors to overcome the impediment, are most powerful and most obvious. In confirmation of this view, I may state that the cases in which I have myself most distinctly traced the peristaltic movement of the bowel have been cases of the kind in question.

It is needless to draw any distinction here as regards treatment between stricture and compression of the bowel.

The following case may be quoted as a typical example of the affection which has just been described. A man, forty years of age, was attacked suddenly, seven weeks before his admission into St.

Thomas's, with severe colicky pains, which confined him to his bed for two or three days. He improved, but at the end of a few days had a recurrence of the same symptoms, lasting for about three weeks, and attended with nausea, vomiting, and constipation. Then for ten days he became free from pain and apparently convalescent. But ten days before his admission all his symptoms returned with increased severity; and during this time vomiting was pretty constant and his bowels remained unopened, although strong purgatives were several times administered. On admission his face was anxious, but his tongue was clean and his pulse quiet. He vomited regularly two hours after taking food. The belly was distended and tympanitic, and somewhat tender; he complained of constant pain in it; and severe exacerbations of pain, lasting two or three minutes, and attended with a gurgling sound, came on about every five minutes. The vomiting became stercoraceous four days after admission, and continued so thenceforth. The bowels were never acted on except by enemata, which brought away fecal matters in gradually decreasing quantities. The distension and tenderness of the belly continued, if they did not increase; and the paroxysms of more intense pain coming on every few minutes troubled him almost to the last. During these paroxysms, the violent peristaltic movements of the bowels could be followed through the abdominal parietes with the greatest facility. He had no distinct febrile symptoms, and no hiccough; he continued perfectly sensible, and died of simple exhaustion just three weeks after admission. At the post-mortem examination, the small intestines generally were found to be enormously distended, and their surface a little heightened in color, and marked with longitudinal bands of rather intense capillary congestion. From the middle of the ileum to within a foot of the cæcum the coils were adherent to one another and to the brim of the pelvis by bands and filaments of false membrane, and were so entangled that their direction was traceable with difficulty. The portion of bowel involved was for the most part somewhat dilated; its lowest third, however, was contracted and empty, as also was the portion between this and the cæcum. The stomach and small intestines down to the seat of contraction were dilated, and full of thin pea-soup-like fluid; the cæcum and large intestines were contracted throughout, but here and there in the ascending colon were small lumps of hardened feces. The mucous membrane of the alimentary canal was healthy everywhere. There was no hernia, no intussusception, and no part of the bowel along which the finger could not readily be passed.

IV. Internal Strangulation.

Internal Strangulation arises from similar causes to those which produce ordinary strangulated hernia, namely, constriction or nipping of a portion of bowel by the edges of some natural or artificial orifice through which it protrudes, with consequent arrest of the circulation of blood in it, and impediment to the passage of fecal matters along it. Such orifices are the foramen of Winslow, congenital or acquired perforations in the mesentery, meso-colon, great omentum, or other peritoneal duplicatures, or apertures formed, with the aid of neighboring parts, by bands of fibroid tissue (the result generally of some inflammatory process) extending from one point of the peritoneal surface to another. [A rarer occurrence is, the invagination of the small intestine in a depression of the wall of the rectum.[1]—H.] And it is obvious that the same accidental conditions which lead to the protrusion of intestine into an ordinary hernial sac, may equally lead to the protrusion of a knuckle or loop or still larger mass of bowels into one of these. But, of course, it no more follows in the one case than in the other that strangulation should either immediately, or at any subsequent period, follow upon this displacement; although in both cases there is always imminent danger of its occurrence.

(*a*) *Pathology.* — Protrusion of bowels through the foramen of Winslow must be an exceedingly rare event. Rokitansky,[2] however, alludes to a case in which he found this the cause of strangulation of a large portion of small intestines. Perforation of the various duplicatures of peritoneum, with the passage of intestine through the perforation, and consequent strangulation is of much more frequent occurrence. This accident appears to be most common in connection with the mesentery, and then generally to follow upon laceration from violence. Next probably in order of frequency it is met with in connection with the great omentum. And cases are recorded in which death has followed the strangulation of a portion of bowel through a hole in the duplicature of peritoneum belonging to the vermiform appendix, or through a hole in the suspensory ligament of the liver, or in the broad ligament of the

[1] Bellamy, London Lancet, i. 1879, p. 337. This patient recovered after laparotomy (abdominal section) and relief of the obstruction.]

[2] Pathological Anatomy: Sydenham Society's Translation, vol. ii.

uterus. Meso-colic rupture is probably a congenital malformation. Three cases of it are recorded in the "Transactions of the Pathological Society;" and in each of them nearly the whole mass of small intestines was contained in a large pouch of the transverse meso-colon, or in the mesentery of the transverse and descending colon. In two of them death was due to disease independent of the rupture; in the third, recorded by Dr. Peacock, the patient died of strangulation. There is probably no part of the peritoneal surface to which bands capable of producing strangulation may not be attached; but there are certain structures and certain conditions of parts with which they are specially apt to be connected. Thus, the vermiform appendix often becomes adherent to neighboring structures, such as the mesentery, small intestine, colon and ovary, forming a kind of loop; thus, too, diverticula of the lower extremity of the ileum become attached, with a similar result, usually by the apex, either to the mesentery or some other neighboring part, or are prolonged to the umbilicus in the form of a cord (a remnant of fœtal life). Again, bands producing strangulation are often joined to the mesentery, or the parts concerned in old ruptures, and often to the pelvic organs, more particularly the uterus, Fallopian tubes, and ovaries. It may here be noted also that strangulation is not very infrequently produced by the slipping of a loop of intestines under the lower edge of the mesentery (unusually elongated), of a portion of bowel hanging low into the pelvis, or even under the pedicle of an ovarian or uterine tumor. Finally, there are rare cases of internal strangulation, in which the bowel protrudes into a lacerated bladder or uterus, or into a perforated bowel, or through the diaphragm. Cases also are occasionally met with in which there is a free communication, generally, if not always congenital, between the peritoneum and pericardium, or one of the pleuræ.

The small intestine is much more frequently strangulated than the large; and of the large intestine the regions most liable to this accident are those which are most movable, namely, the cæcum and sigmoid flexure. Internal strangulation occurs at any age; generally, however, above thirty; but strangulation in connection with the appendix vermiformis, or a diverticulum happens most frequently in comparatively early life, the average age being, according to Dr. Brinton, twenty-two years; further, strangulation from diverticula and from lacerated mesentery is according to all authorities, far more common among males than females. It has already been pointed out that there is a very important relation between peritoneal bands and sacs of old herniæ, and in females between such bands and the pelvic organs.

(*b*) *Symptoms.*—The symptoms of internal strangulation are identical with those of ordinary strangulated hernia, and so like those which have been described as the symptoms of the severer form of enteritis that there is no occasion to give here any special account of them. It need scarcely be added that they differ essentially from those of stricture and of compression of the bowel, in the facts that they are always sudden in their origin and acute in their severity and progress, and always end fatally (if the stricture be not relieved) within a few, rarely more than five or six, days.

(*c*) *Treatment.*—As regards the general management and medical treatment of these cases, nothing can be added to what has already been laid down in reference to enteritis. But whenever the diagnosis of an internal strangulation has been made, it must of necessity become a question whether an operation should be performed with the object of relieving it. There can be no doubt, of course, that the liberation of a portion of bowel strangulated by any of the various causes above enumerated ought *cæteris paribus* to be attended with as good results as the division of the stricture in ordinary cases of strangulated hernia; but there is also no doubt that operations performed with that intention have not on the whole afforded any encouraging results. When, however, we consider that although typical cases of the different kinds of intestinal obstruction may really present characteristic peculiarities of symptoms, it is yet for the most part exceedingly difficult in practice to discriminate the cases that come before us, and that therefore operations must comparatively often be performed where from the nature of things they must be useless; and, further, that while even in the case of the operation for ordinary strangulated hernia its early performance is generally essential for its success, in the case of internal strangulation the operation, if performed at all, is almost always delayed until a late stage in the disease; it is not hard to understand why so little success has attended the operative treatment of the cases under consideration. A sufficient number of operations has, however, been successful to justify us in laying it down as a rule, first, that in every case in which we have come to the conclusion that a patient is suffering from internal strangulation, an operation should be performed for its relief; secondly, that in all cases in which we think it not improbable that such a strangulation exists, the patient should not be allowed to die without an exploratory operation having been effected or at least proposed.

(*d*) *Note on Torsion or Twisting of Bowel.*—There is a class of cases, far from uncommon, which may be conveniently adverted to here. They are cases of what is called "Torsion" or "Twisting" of the bowel. It has already been shown that fatal obstruction to the passage of fecal matters along the bowel may be caused, or appear to be caused, by the formation of some abnormal abrupt bend, or twist, in connection usually with external adhesions. In these cases, however, death is caused, as in stricture or compression from without (with which last I have classed them), by obstruction alone. But in the cases now to be considered, the twisted portion of bowel becomes the seat of enteritis, and death results speedily, with the symptoms of enteritis rather than those of obstruction. The cases, indeed, clinically seem to be undistinguishable from cases of enteritis or internal strangulation. The onset of the disease is sudden, the symptoms acute and severe, and the supervention of collapse and death speedy. And on examination after death there is found a length of bowel greatly dilated and black with congestion and inflammation, if not gangrene, no strangulation, at least no strangulation in the ordinary sense of the word, but instead, a remarkable twisting of the inflamed tract of bowel with its mesentery, by which twisting it is supposed that the vessels leading to and from the part have become obstructed. Such twisting, associated with inflammatory mischief, is sometimes observed in the small intestine; but it is far more commonly met with in connection with the larger bowel, and especially with the sigmoid flexure and cæcum. If these cases be really, as is generally believed, cases in which strangulation of the bowel is produced by the twisting of itself and its mesentery, they naturally fall under the head of internal strangulation, with which, as has been pointed out, their symptoms and progress ally them. I must confess, however, that I have a strong inclination to believe that most, if not all, recorded cases of this affection are essentially cases of enteritis, and that the twisting is a secondary phenomenon only. It is not very easy to see how a portion of bowel, unless its position be altered and its movements interfered with by adhesions (and certainly in many of the cases no adhesions whatever are observed), can become so twisted by any movements of its own, or even by the pressure of surrounding healthy parts, as to be either strangulated or incapable in virtue of its own peristaltic movements of recovering its normal position; but it is easy to see that an inflamed and paralyzed portion of intestine, heavy with accumulated contents, dilated to many times its normal bulk, and forming a doughy, inelastic, inert mass, may under certain conditions by its mere weight subside from its normal site, or be pushed aside by the pressure of the actively vital parts around it, and so be made to assume a position and form suggesting the generally received explanation of the sequence of events.

V. Impaction of Foreign Bodies.

It has already been pointed out that mere ordinary intestinal contents, no matter how unwholesome, how indigestible, or how imperfectly comminuted the ingesta from which they are derived may be, very rarely indeed cause by their accumulation permanent intestinal obstruction; yet it is not improbable that, according to the ordinary belief, undigested masses of food do sometimes, in their passage along the small intestine, move with difficulty, or become temporarily impacted, and so produce pain and sickness, and even symptoms of obstruction. Dr. Brinton describes a case of this kind, in which he asserts that he distinctly traced by palpation a mass of half-chewed filberts in its passage (lasting two days) along the small intestine.

(*a*) *Pathology.*—Foreign bodies, indeed, of comparatively small size, such as coins, fragments of bone, teeth, marbles, plumstones and cherry-stones, generally pass along the healthy intestine without causing any material inconvenience; and occasionally even pointed bodies—pins and the like—prove equally innocuous. They are all, however, a source of serious danger in the presence of strictures, above which they usually become arrested, or in which they may become lodged. The smaller ones among them may lead also to serious results by slipping into a diverticulum, or into the vermiform appendix; and those which are pointed are apt to perforate the intestinal wall, and thus, escaping into the peritoneal cavity, to set up fatal peritonitis, or, escaping into the surrounding tissues, to provoke suppuration there. In the latter case, the foreign body sometimes emerges through the abdominal parietes, sometimes (when it perforates the rectum) is the cause of anal fistula.

Insoluble matters, in the form of powder or in a fibrous state, which under ordinary conditions may be swallowed with perfect impunity, occasionally after having been taken habitually in large quantities and for long periods, are found to have been gradually deposited from the fecal contents of the bowels, and to have concreted into hard masses. These are sometimes round or ovoid, and may then be termed intestinal calculi, and sometimes form casts of the portion of gut in

which they lie. The former are probably always found in the large intestine: the latter rarely, if ever, occupy any other position than the rectum. Among substances which thus occasionally form concretions, are sesquioxide of iron, carbonate of magnesia, insufficiently cooked starch, and oat-hair derived from oat-cake and other articles of food made from oats [also undigested coagula of milk.—H.].

Amongst cases of exceptional rarity may be included those which are here and there recorded of persons who have been in the habit of swallowing knives, or pins, or string, or hair, or cocoa-nut fibres; things which, from various causes, are somewhat difficult of transmission, and which with the constant additions which are made to them gradually form accumulations or masses, which sometimes attain very considerable dimensions, and may then easily be distinguished through the abdominal walls. These are generally found to occupy more particularly the stomach and upper part of the small intestine, and, when composed of fibrous substances, take the shape of the cavity in which they have formed. Their presence causes gradual dilatation of the part in which they are lodged, then congestion, inflammation, and ulceration, and finally, either perforation into the peritoneal cavity, or complete obstruction. It is remarkable, however, how long a period often elapses before such cases terminate in death, and how little, comparatively, of distress or even inconvenience the patient often experiences previous to the supervention of fatal symptoms.

But the usual cause of fatal impaction, and that which comes more especially within the scope of the present article, is the escape of a large gall-stone from the gall-bladder into the small intestine. The gall-stones here referred to are not those which so commonly slip from the gall-bladder into the cystic duct, and thence (if they do not become firmly fixed there) into the duodenum; for although these cause grave symptoms enough so long as they are retained within the biliary passages, they cease, as a rule, to cause any ill effects so soon as they have gained an entrance into the bowel; their comparative smallness allowing them to pass along the intestines and to escape with the feces, just as a plum-stone or a cherry-stone might do. The biliary concretions which become impacted in the bowel are single stones, or masses of coherent stones, of considerable bulk, varying, at a rough estimate, from three to four inches in circumference, and from one inch to two, three, or even four inches in length; in the former case presenting more or less of the ordinary cuboidal form, in the latter case forming a more or less complete cast of the gall-bladder. It is obviously scarcely possible that concretions of this magnitude can escape from the gall-bladder *per vias naturales;* and there is reason to believe that in all cases where a careful examination has been made, an ulcerated opening has been discovered, by which the cavity of the gall-bladder and that of the duodenum were in tolerably free communication, and through which the concretion had obviously escaped from its bed. When a large calculus has thus got into the duodenum, it seems to be carried on with the other contents of the bowel by means of the ordinary peristaltic movements. But its mere bulk prevents it from moving readily: besides which it provokes by its shape and hardness, as well as by its bulk, some irritation, if not inflammation of the mucous surface over which it passes, and more or less spasmodic contraction of the muscular tissue which surrounds it. It hence continues to progress irregularly, now moving slowly, now coming to a standstill, impelled onwards by the *vis à tergo*, checked in its passage by the spasmodic contraction of the portion of bowel which embraces it, and by the comparatively empty and contracted state of that which is below it, and causing as it descends more and more mischief to the mucous surface, until finally it becomes impacted, sometimes in the jejunum, sometimes in the ileum, and not unfrequently just above the ileo-cæcal valve. Then all the effects of complete obstruction, conjoined with those of intense enteritis, supervene; the bowel below becomes empty, that above distended with accumulated contents, and generally more or less inflamed, while at the seat of obstruction and in its immediate neighborhood the inflammation becomes intense, extending speedily to the peritoneal surface, and ends not rarely in gangrene and in perforation. Gall-stones rarely, if ever, become lodged in the cæcum, colon, or any other part of the large intestine.

Gall-stones are a product of the later period of life; and hence obstruction by gall-stones can only be looked for at an advanced age. It occurs indeed rarely before the fiftieth year, and, it may be added, much more frequently in women than in men. Dr. Brinton estimates the average age of its occurrence at 53½ years, and that it occurs four times as frequently in women as in the opposite sex.

(*b*) *Symptoms and Treatment.* — The symptoms which indicate obstruction of the bowels by a gall-stone are as nearly as possible identical with those which attend internal strangulation or enteritis. The cases themselves are, however, amongst the most violent in the symptoms and the most rapid in their course of all cases of intestinal obstruction; con-

ditions which result partly from the intensity of the inflammation which attends them, partly from the fact that the obstruction is almost without exception situated in the small intestine, and often high up in it. Dr. Brinton calculates their average duration at five days. There are two or three circumstances which may afford more or less assistance in the discrimination of obstructions by gall-stones; such are, first, the age and sex of the person attacked; second, the possibility in certain cases of discovering by palpation the presence of a gall-stone (that is to say, of a solid mass) in the bowels, and even of tracing in some degree its progress; and third, the occurrence of precursory symptoms due to the escape of the gall-stone from the gall-bladder, and to its presence in the bowel in the interval between this escape and its final impaction. It must not be forgotten, however, that in practice not only do we often fail in these cases to recognize a lump, or to obtain a history of premonitory symptoms; but that we may have both a lump and a history in cases where the symptoms are wholly independent of the presence of a biliary calculus or other foreign body. There does not appear to have been observed any connection between ordinary "attacks of gall-stones," and the affection now under consideration. This circumstance, however, is not remarkable, when it is borne in mind that gall-stones which escape by the normal route must necessarily be small, and that the escape of one such stone makes the way of escape for others that may be in the bladder comparatively easy, whereas those which cause intestinal obstructions are always large, and are often casts of the gall-bladder.

It may be added here, that not all large gall-stones cause death, after their entrance into the bowel, by obstructing it. They sometimes become encysted in a pouch which they have themselves been instrumental in producing. Dr. George Harley[1] records a case in which a gall-stone became thus lodged in the duodenum. Sometimes, again, they escape *per anum*. It is of course impossible to lay down any law as to the limits of size beyond which it is impossible for a solid body to pass through the ileo-cæcal orifice; but there are good grounds to suspect that in most cases where large calculi have been voided, they have passed by ulceration directly from the gall-bladder into the colon.

No distinction need be made between the treatment of cases of obstruction by gall-stones, and that of cases of enteritis.

[The exclusion of operative interference here implied is not acted upon by all surgeons. Bryant, for example,[1] not long since opened the abdomen in a case of intestinal impaction with gall-stone; without saving the patient, however. The success in some cases of *cholecystomy* (opening the gall-bladder) for the relief of distension caused by gall-stones in the *ductus choledochus*, seems to give justification for operating when the same cause produces obstruction of the intestine.—H.]

[1] Path. Soc. Trans. vol. viii.

VI. Intussusception.

(*a*) *Pathology.*—By intussusception is meant the prolapse or slipping of a tuck of intestine into the cavity of the portion of intestinal tube immediately below it, wherewith it is continuous. In consequence of this, we find the normal course of the intestine interrupted by a kind of knot, in which three successive lengths of bowel lie almost concentrically one within the other; the innermost length being formed by the portion of bowel which has descended, the outermost length consisting of the portion of bowel into which the descent has occurred, the middle or intermediate length being the portion of bowel which unites the upper extremity of the one with the lower extremity of the other, and lies therefore in an inverted and everted position between them. The mesentery of the inner two, or included, lengths of bowel is in their descent necessarily dragged down with them into the pouch which they form, and, by the unilateral traction which it exerts, necessarily gives to their double tube a curvature of which the concavity corresponds to the line of mesenteric attachment; so that the lower orifice of the invaginated portion of bowel, instead of lying in the axis of the containing bowel, faces and rests upon some portion of its circumference. The several layers are generally more or less convoluted (with convolutions running transversely) or twisted: but this convolution or twisting is always most marked in the middle tube. The immediate effects of intussusception are, first, more or less obstruction to the passage of the intestinal contents, and, second, more or less obstruction to the return of blood from the inner two cylinders of bowel involved, to which the stretched and constricted portion of mesentery belongs. It is obvious that the innermost tube must be pretty tightly compressed by the tubes external to it, a condition which must be much increased by the swelling of parts which speedily takes place; especially it is always found to be very tightly girded at its point of entrance by the tumid ring formed at the junction of the outer two layers. Nevertheless,

[1] Brit. Med. Journal, i. 1879, p. 308.]

the obstacle which an intussusception opposes is often incomplete, for it is certain that in a good many cases fecal matters, not always in small quantities, pass through it pretty constantly: a circumstance due, in part, to the efficiency of the contractile force of the bowel above to squeeze a portion of its contents into the narrowed tube below, but chiefly to the retention still of contractile power in the affected portions of bowel. Very soon after the occurrence of intussusception all the tissues of the inner two tubes, internal to the serous membrane, become black or nearly so with congestion and escape of blood into their substance, and the

[Fig. 9.

Intussusception, with diagram showing the entering, returning, and receiving layers of ileum into colon.]

serous surface consequently assumes a more or less deep slate-color. At the same time, partly from the accumulation of blood, partly from the transudation of serum, their walls become very greatly swollen, and sanguinolent serum or blood becomes effused from the mucous membrane, and may be found collected both in the interval between the opposed mucous surfaces of the outer two layers of the intussusception, in the central canal, and in the bowel below the seat of disease. At a somewhat later period coagulable lymph is secreted from the opposed serous surfaces of the middle and internal layers, and these become consequently agglutinated in their whole length. The two invaginated tubes remain sometimes for a long while in the condition above described, but often ere long become gangrenous, and then, if the patient survive sufficiently long, separate from their attachments and become discharged *per anum*.

Intussusception is doubtless always an accident of sudden occurrence in connection with some violent spasmodic action of the portion of bowel which becomes prolapsed. It seems certain, however, that there must be some associated conditions which concur with spasmodic action in producing it. A wave of peristalsis is made up of two distinct elements: first, the contraction of the longitudinal fibres which shortens the bowel and dilates it, and (since it travels from above downwards) draws the portion of bowel below, in which the contraction is commencing, towards the portion of bowel above, in which the contraction is completed; second, immediately following upon this, the contraction of the circular fibres which narrows the bowel and elongates it, and, in elongating it, projects the narrowing segment forward. Now, it is obvious that in these two associated elements, namely, the dilatation of one segment of the bowel with a tendency in its lower part to be drawn upwards, and the narrowing of the segment of bowel immediately above it with a tendency in its lower end to be pushed forwards, we have conditions which, with very slight modifications or exaggeration, might permit of the protrusion of the narrowing segment above into the dilated segment below. The circumstances which either alone or in combination might have this effect would seem to be: first, the presence of much gaseous matter leading momentarily to excessive distension of the portion of bowel into which the wave of circular contraction is advancing; second, immobility from whatever cause of this distended portion of bowel, so that it is not pushed on bodily by the elongation of the narrowing segment above; and third, the occurrence at this moment of some violent muscular effort, involving the action of the muscular parietes of the abdomen. The efficiency of these, or of equivalent circumstances, in causing descent of the bowel, is shown in the cases of prolapse of the rectum, and prolapse of bowel through an artificial anus; as well as in the most common use of intussusception, namely, that in which the extremity of the ileum slips into the cavity of the cæcum. It is supposed that the presence of lumbrici occasionally determines the occurrence of intussusception, and with more reason that the presence of a large polypus has this effect. It may be remarked, however, that in some of the recorded examples of concurrence of intussusception and polypus, the intussus-

ception and polypus have been at a distance from one another.

In every case an intussusception must obviously in the first instance involve a short length of bowel only; but for the most part it rapidly increases in size owing to the active peristaltic movements of the several segments engaged. This increase takes place partly by the prolapse of more and more bowel from above, but chiefly by the involution of more and more of the outer layer. In most cases, indeed, if not in all, the parts which in the first instance formed the margins of the lower orifice of the invaginated portion of bowel, continue to form that orifice, no matter what length the intussusception may ultimately attain. The growth of the innermost tube therefore is the result simply of the descent of more and more bowel from above, while the growth of the middle tube takes place at the expense of the outermost tube only in consequence of its gradual inversion.

The length of bowel involved in an intussusception varies within wide limits. Including in our measurement the inner two layers only, or those which constitute the intussuscepted portion, the length varies from two to three inches up to three or four feet. A case indeed is quoted by Dr. Peacock,[1] in which, judging from the combined lengths of portions which escaped from time to time *per anum*, there is reason to believe the invagination had comprised twelve feet of bowel.

Intussusception is rather more than twice as common in males as in females, both before and after puberty. It occurs at all periods of life, but is singular, amongst obstructive diseases, in the frequency with which it affects young children.

Intussusception is not very infrequently met with after death in persons (children and adults) in whom during life there had been no reason to suspect its presence, who have had no symptoms which can be attributed to it, and who have died of some totally different disease. In these cases, the intussusceptions are always found in the small intestine—sometimes, indeed, two or three are met with in the same case—they are generally not above an inch or two long, are easy of reduction, and present little or no œdema or congestion. It is not impossible, as has often been suggested, that similar slight intussusceptions take place occasionally during good health, and having caused symptoms of more or less severity, undergo spontaneous evolution with restoration of the integrity of the bowel. Intussusceptions which prove fatal may occur in almost any part of the intestinal canal, but they occur in different regions, with very different degrees of frequency. Out of 100 fatal cases (according to Dr. Brinton's figures), 4 are jejunal, 28 iliac, 56 ileo-cæcal (that is, involving the cæcum together with the ileum and colon), and 12 colic, or originating in and involving the colon only. It must be noticed, however, that recoveries with separation of the intussuscepted bowel are much more numerous in those cases in which intussusception occurs in the small intestine than in those cases in which it involves the colon, a fact which renders it more than probable that the jejunal and iliac varieties form a larger proportion of the whole number of cases of intussusception than Dr. Brinton's figures might lead us to believe. It may be added, moreover, that intussusception occasionally begins in the rectum, of which Dr. H. Fagge quotes an example; and that prolapsus of the rectum, which in some cases involves the descent of the muscular wall together with that of the mucous membrane, is under these latter circumstances a true intussusception.

Jejunal or iliac intussusception is met with generally, if not exclusively, in adults. The average age of its occurrence is, according to Dr. Brinton, 34·6 years. It is here that the peculiar curvature of the invaginated part, due to the traction of the mesentery, is most observable; and it is here, owing probably to the comparative narrowness of the tube into which the invaginated portion of bowel descends, that strangulation and congestion are most speedy and most intense, and that sloughing and separation of the strangulated part are consequently most frequent. The length of bowel engaged in this form of invagination, although it may be as much as several feet, is generally less than in intussusceptions involving the large intestine.

Ileo-cæcal invagination occurs largely amongst young children, including babes only a few months old. Dr. Brinton considers that half the total number of cases are in children under seven years of age; and that the mean age of those affected by it is 18·57 years. It begins with the descent into the cavity of the cæcum of the lips of the ileo-cæcal orifice, which form henceforth the lower extremity of the invagination. As this increases, the descending ileo-cæcal orifice drags down with it more and more of the ileum to form the central tube, and inverts first the cæcum, and then a gradually increasing quantity of the colon, to form the inverted or middle layer; and still descending, finally in some cases reaches the rectum or even protrudes from the anus. It may be added that the orifice of the vermiform process necessarily retains its position relatively to the ileo-cæcal orifice, and that the process itself therefore lies at the bottom of the pouch between

[1] Path. Trans. vol. xv.

the inner and middle tubes. In ileo-cæcal invagination, which is that in which the greatest length of bowel may be engaged, there is generally much transverse folding of the several layers of intestine which form it, especially of the middle layer, which is also often much convoluted or twisted. Strangulation is comparatively much more rare here than in intussusception limited to the small intestine, doubtless because of the comparative roominess of the colon: and in a proportionate degree sloughing and discharge of the invaginated tissues are necessarily uncommon.

A variety of ileo-cæcal invagination of very rare occurrence is that in which the lower extremity of the small intestine descends into the cæcum through the ileo-cæcal orifice; the lips of the orifice not necessarily descending with it. Strangulation in this case is said to be generally sudden and complete, in consequence of the tightness with which the prolapsed bowel is gripped by the valve. Colic and rectal intussusceptions are comparatively infrequent, and differ little, except in the parts involved, from the ileo-cæcal form of the affection.

If the patient survive sufficiently long after the formation of an intussusception, events take place in connection with it which have already been briefly indicated. The peritoneal inflammation which by its products unites the opposed serous surfaces of the inner two layers, may spread beyond its primary seat, and cause more or less general peritonitis. Or, after these two layers have become united, a further descent of bowel may take place, producing what is called a double intussusception—an intussusception, that is to say, in which the bowel above has slipped in the form of a second invagination into the canal of the primary invagination. Or, again, as Dr. Aitken[1] shows, the extremity of the curved invaginated portion of bowel may, by the constant pressure which it exerts against the side of the containing tube, cause at the seat of pressure ulceration and perforation of the intestinal wall. But by far the most interesting and important event is the sloughing and separation of the included layers of bowel. It has been shown that almost immediately after the occurrence of invagination, these become œdematous, intensely congested, and infiltrated with blood; and it might be supposed from the obstruction to which the vessels supplying them are exposed, that their death must necessarily speedily ensue. In many cases, however, patients live for weeks, and even months, after the occurrence of invagination, with no further changes in the contained tubes than those due to mere congestion and swelling, and die ultimately from the effects of invagination, the bowel never, even to the last, showing signs of either ulceration or gangrene. This (as has been stated) happens rarely, if ever, in intussusception limited to the small intestine, but it is very common in the case of ileo-cæcal and colic invagination. But in many instances, and (as has also been stated) far more frequently in the case of the small intestine than in that of the large, the deep congestion ends in the death of the intussuscepted portion; which then after a while, if the patient still survives, becomes detached either bit by bit or in mass, and gradually working its way downwards becomes expelled. This separation generally leaves the upper extremity of the outer tube of bowel firmly united, at the neck of the intussusception, with the lower extremity of the healthy bowel above, the line of union between the two being indicated by an annular fissure externally, and by a ring of ulceration on the mucous aspect, attended with more or less diminution of the calibre of the intestine, and to which sometimes portions of the intussuscepted bowel still living and forming a sort of excrescence remain adherent. Sometimes at the moment of separation of the sequestrum, the union between the upper and lower parts of the bowel is not complete, and escape of fecal matter takes place into the peritoneal cavity: and not unfrequently after the detached portion of bowel has been discharged *per anum*, and the patient promises to make a fair recovery, the seat of separation becomes more and more narrowed, and ends by becoming a tight stricture.

Of thirty-five cases of discharge of bowel *per anum*, collected by Dr. Thomson,[1] sixteen appear to have recovered perfectly, and nineteen died after a longer or shorter interval; and out of nineteen cases, collected by Dr. Peacock,[2] in which the result is mentioned, nine made a good recovery, five still suffered from symptoms indicative of obstruction, and five died subsequent to the discharge of bowel, at intervals varying from forty days to thirteen years. With regard to the period at which the separation takes place, it appears, from Dr. Peacock's paper, that in several cases bowel was discharged on the sixth or seventh day after the beginning of the disease; that in most the discharge took place before the twentieth or thirtieth day; and that occasionally the bowel was not passed until after a few months or even one year had elapsed. In one case fragments of bowel were expelled at intervals during a period of three years.

[1] The Science and Practice of Medicine, vol. ii.

[1] Dr. Peacock's paper: Path. Trans. vol. xv. p. 113.

[2] Ibid.

Lastly, in reference to the portion of intestine which thus escapes, it appears that out of forty-three of the cases cited by Drs. Thomson and Peacock, in thirty-two it consisted of small intestine alone, and in eleven only comprised a part of the larger bowel. [The extent of intestine which may thus come away, even in cases which result favorably, is sometimes wonderful. Flint[1] gives an account of two cases, in each of which several feet of intestine were, in all, discharged.[2]—H.]

(*b*) *The Symptoms* which attend intussusception are made up partly of the symptoms of intestinal obstruction, partly of those of enteritis; but they present much variety, and are often so vague as to render, for a time at least, accurate diagnosis impossible. There are nevertheless certain characteristic symptoms, which if present point pretty certainly to the existence of the lesion in question.

The commencement of intussusception is attended with sudden and more or less severe abdominal pain of a griping or twisting character, which is referred usually to the neighborhood of the umbilicus. This generally ceases after a short time, perhaps a few hours, and then after an interval of comparative or total ease returns temporarily, and thus perhaps continues to recur remittently. There is not necessarily any abdominal tenderness, and indeed the patient frequently finds relief, as in colic, by various contortions of the body and by pressure upon the abdominal parietes. Sympathetic vomiting may be an early symptom, but is often in the beginning absent. Constipation generally follows upon the sudden attack of pain: not however immediately, for the bowel below the seat of lesion may, and does generally, continue to act upon its contents until they are completely expelled: nor necessarily, because, as has been pointed out, the intussusception does not in all cases entirely prevent the passage of fecal matters from above; and, sometimes, indeed, instead of any tendency to constipation there is actual diarrhœa. There is one peculiarity, however, in connection with the intestinal evacuations, which is rarely absent; it is, that very soon after the occurrence of intussusception, the blood which escapes from the deeply congested mucous surface of the invaginated bowel mingles with the contents of the bowel below, and escapes with them by stool in greater or less abundance.

The symptoms which mark the subsequent progress of the case depend partly on the situation of the intussusception, partly on the degree in which the bowel is strangulated. It has been shown that when the intussusception involves the large intestine, actual strangulation occurs somewhat rarely, and the case tends to become much protracted. In this event the symptoms are apt to be very ill-defined: the paroxysms of pain are often slight, and recur at distant intervals; constipation may exist at the beginning only, or may occur from time to time, or it may never be distinctly present; there is generally more or less vomiting. As the case, however, progresses, the pain often increases in severity; the vomiting becomes more and more incessant and possibly stercoraceous; the alvine evacuations either continue to pass or become re-established, blood and mucus are discharged in variable quantities, and even dysenteric diarrhœa comes on. And then after a longer or shorter period, sometimes after two, three, or four months, the patient, who has been gradually getting more emaciated and feeble, dies of simple exhaustion. When the invagination occupies the small intestine, strangulation is usually of rapid occurrence, and its occurrence adds to the symptoms of mere intussusception those of enteritis. The case, therefore, speedily assumes a very threatening aspect. Febrile symptoms manifest themselves, the abdomen becomes tender, incessant vomiting comes on, and the bowel becomes obstructed, or at all events discharges only those matters which the congested and gangrenous tissues pour out. Under such symptoms, the patient, as in uncomplicated enteritis or internal strangulation, may speedily succumb; but sometimes, at a moment when the disease appears to be still progressing unfavorably, the constipated bowel begins to act, offensive stools mixed with blood and mucus begin to be discharged with more or less tenesmus, vomiting diminishes or ceases, febrile symptoms abate, and after a longer or shorter period of dysenteric symptoms a sequestrum is passed *per anum* in the form of a dark fetid gangrenous mass.

The most characteristic features, amongst those which have been enumerated in the symptomatology of intussusception, are, first, the sudden onset of the malady, with pain and more or less constipation and vomiting; and secondly, the discharge of blood *per anum* which is generally present even from the beginning. But there is a third sign, to which no allusion has yet been made, which is perhaps of even greater importance, namely, the presence of a tumor. It can scarcely happen that any length of a threefold tube of intestine, especially

[1 Principles and Practice of Medicine, 4th edition, p. 421.]

[2 Tremain (Canada Med. and Surg. Journal, vol. vii. 1879, p. 450) narrates a case in which recovery took place after seventeen inches of intestine had passed away.]

when its layers, one or all, are congested and swollen, can be present without forming a tumor capable of detection by careful palpation through the abdominal walls, provided at least these be not too fat or too rigid, or the bowels generally be not too much distended with gas, or the abdominal tenderness be not too great, to admit of satisfactory examination. The presence of a tumor indeed, especially in the case of ileo-cæcal, or colic, invagination, may often be recognized during life; and that the tumor is an intussusception may also often be recognized, partly by its cylindrical form, partly by its position, but especially by the fact that it may in some cases be detected changing somewhat from day to day in form and direction, as the intussusception increases, and may sometimes also be felt to dilate and harden, and then subside, under the influence of its peristaltic movements. Further, in those cases in which the intussusception extends low into the rectum, its lower extremity may be detected with all its characteristic features by the finger inserted into the anus.

It must not be supposed, from the foregoing observations, that there is always a wide distinction between the symptoms of invagination of the small intestine and those of invagination of the large intestine. There is no doubt that the majority of jejunal and iliac invaginations are marked by the violent symptoms and rapid progress which have been assigned to them, and that the majority of invaginations involving the large intestine present less urgent symptoms and assume a chronic character. But undoubtedly in some cases invaginations of the small intestine approximate in symptoms and in progress to those of the large intestine, and in a still larger proportion of cases cæcal and colic intussusceptions are attended from an early period with symptoms of great urgency and prove rapidly fatal. These differences depend apparently on the presence or absence of strangulation, which, as has been shown, may occur in connection with any form of invagination, but which generally occurs early when the small intestine alone is affected, late and perhaps not at all when the large intestine is the seat of disease. And it is important to bear in mind that it is this very strangulation, leading to engorgement, inflammation, and gangrene of the invaginated tract of bowel, which, while it gives rise to the most urgent and distressing symptoms and not unfrequently induces speedy death, is effecting the separation of the obstructing mass, and thus leading to the only possible solution of the case compatible with restoration to health.

There are several additional points in which as a rule differences available for diagnosis are manifested between invaginations of the small and large intestines respectively. Dr. Brinton has especially dwelt upon them. First, tenesmus is common in invagination of the large intestine, but is not necessarily present, and is generally absent when the small intestine is affected; secondly, hemorrhage from the bowel (connected doubtless with the relative degrees of congestion of the invaginated portion of bowel) is much more copious in invagination of the small intestine than in that of the large, and blood may also in the former case be vomited; thirdly, obstruction of the bowels is a more prominent symptom when the small intestine is affected, than when the large intestine is affected. The remaining points on which Dr. Brinton insists, namely, the situation of the tumor within the abdomen, and the discovery of the end of the intussusception in the rectum, have been already discussed.

Hitherto it has been supposed that the case of intussusception has been uncomplicated with any other malady; but it must not be forgotten that general peritonitis may come on at any time in its progress, and that it is sometimes induced by perforation of the bowel. The latter event is especially apt to occur at the time of separation of the slough, and necessarily renders a case, already sufficiently precarious, hopeless.

The percentage of deaths in intussusception must be very large; it is very difficult, however, if not impossible, to estimate what that percentage is. The stage at which patients die, and the immediate cause of death, present very great varieties. Dr. Brinton estimates that the average duration of cases directly fatal is five and a half days. This estimate may probably be accepted with regard to those cases in which strangulation marks the onset of the intussusception, and generally therefore with regard to invagination of the small intestine; but, as Dr. Fagge points out, it can only be true, in a qualified sense, of invagination of the large intestine—namely, if we reckon the duration of the case from the first manifestation of symptoms of strangulation, and not from the moment at which invagination commenced, which may have been many weeks previously. In cases in which there is not immediate strangulation, the patient may survive for weeks or months, ultimately dying of exhaustion, or killed by the supervention of strangulation. Even after the slough has been discharged, and the continuity of the segment of bowel above and that below the neck of the invagination has been established, permanent recovery would seem to be less frequent than ultimate death—death being induced at vari-

ous intervals afterwards, either by exhaustion or by the effects of stricture of the bowel. Recovery after the separation of a portion of the small intestine seems to be more frequent, both relatively and actually, than after the separation of a portion of the large intestine.

(c) *The Treatment* of intussusception, like the treatment of other forms of intestinal obstruction, must be on the whole negative; or, to be more explicit, the less actively the patient is treated, the more likely is he to have his life prolonged, and ultimately to recover. Here, as in most other kinds of obstructive disease, all forms of purgatives must be eschewed, everything in fact must be avoided which can have the effect of promoting peristalsis; for violent movements of the bowel, independently of any other mischief they may effect, naturally tend to increase the size of the intussusception. Neither must it be forgotten that the special ground on which alone the administration of purgatives may be urged exists less in intussusception than in other forms of obstructive disease; for constipation is rarely complete at any rate for more than a few days. On the other hand, opium is of extreme value for the sake both of relieving the pain due to enteritis, or to violent peristalsis, or both, and of restraining the exaggerated movements of the bowel. Dr. Brinton suggests that belladonna, on account of its relaxing influence on the unstriped muscular fibres, may be given with advantage, either alone or combined with opium. Enemata are often beneficial, partly by relieving the lower bowel, partly, perhaps, by acting as a kind of internal fomentation. They may, however, possibly have another value, at all events when administered in large quantities, gradually and without violence. Thus there is some reason to believe that where the large intestine is affected, the distension caused in the external tube of the intussusception, and the pressure exerted on the invaginated portion of bowel itself by such injections cautiously administered, may in some cases, especially those of recent origin, and where the length of bowel involved is as yet small, avail to effect its restoration. Inflation of the bowel *per anum* was long ago recommended for the same purpose; and of late years this procedure has been revived, and several cases have been recorded in which it seems to have been successful.[1] It is obvious, however, that, as is the case with ordinary enemata, inflation can only be of service when the invagination involves the large intestine, and when it is in an early stage. But in intussusception, as in other forms of disease attended with obstruction, the question of surgical interference is not unlikely to arise—Can any surgical operation be performed with a prospect of benefit? It may be supposed that it would be no difficult matter, after opening the abdominal cavity, to withdraw from its sheath an intussuscepted portion of bowel; and no doubt, if adhesions had not yet been formed, or if gangrene had not yet taken place, the evolution of the intussusception might be effected; yet even then considerable force would have to be applied, especially if the intussusception were large, and much risk of damage would attend the process of retraction. Assuming then that an operation might under certain conditions be attended with advantageous results, the question as to what these conditions are naturally presents itself. Now, considering how acute are the symptoms which attend invagination of the small intestine; how speedily adhesions, gangrene, and separation of the slough begin to take place in it; how difficult it is to feel sure of the nature of the case at that early period when alone an operation would have a chance of success; and moreover how often (comparatively) the patient is restored to health by the spontaneous discharge of the invaginated length of bowel—it seems scarcely possible to avoid the conclusion that in these cases at least surgical interference should be discarded. But when, on the other hand, we bear in mind that in intussusception of the large intestine, ultimate recovery is exceptionally rare, even after the separation of the invaginated portion of bowel, that this separation is of very infrequent occurrence, and that the invaginated bowel is apt to remain in a fairly healthy condition for weeks, sometimes, after the commencement of the disease, it is obvious that we have here an opportunity for operation and a chance of benefit from it very much more favorable than those which iliac and jejunal intussusceptions offer. And it becomes difficult not to accept the conclusion to which Dr. H. Fagge comes, which is to the effect that it is in these cases, and in these alone, that the question of operating should be seriously entertained.

[1] A soda-water siphon bottle has sometimes been used with advantage for this purpose.—H.]

Concluding Remarks.

Before finally dismissing the subject of intestinal obstructions, it may be convenient to consider, however briefly, some of the more important points upon which our discrimination of such cases of obstruction as may come before us must mainly depend, as well as some of those points of treatment which have a general value in reference to them.

(*a*) *Pain* is a more or less general and prominent symptom in all cases of obstruction, but it varies a good deal in different persons, both in duration, character, and severity. It is partly the pain of peritonitis, partly that of colic, and these may be present separately, or variously combined. Hence it can be readily understood, that although in well-marked cases the character of the pain may afford us valuable assistance in determining whether the peritoneal surface is alone diseased, or whether the inflammation affects the inner tunics only of the bowels, or whether it involves pretty equally the peritoneal, muscular, and serous coats; in others it affords no evidence whatever of a trustworthy kind. I have a distinct recollection of one of the most extensive and severe cases of enteritis I ever saw, associated with peritoneal inflammation, which a quite well-experienced medical man regarded almost to the last as one of simple colic. It may be added, that even where there is distinct inflammation of a length of bowel, the pain and tenderness, instead of occurring immediately superficial to the affected gut, are frequently most marked in the umbilical region. This latter peculiarity is manifested not unfrequently in cases of inguinal or femoral hernia, and is, indeed, a not uncommon characteristic of affections of the small intestines.

Painful peristaltic movements coming on in paroxysms constitute one of the most distressing, and at the same time one of the most characteristic, symptoms attendant on obstruction; yet, although they may be present in a marked degree in all forms of obstruction, I agree very much with Dr. Fagge in the belief that they are for the most part most severe and most constant in the cases of longest duration; in the cases, therefore, in which enteritis is either not present at all or occurs late.

(*b*) *Vomiting* is rarely if ever absent from the various affections now under consideration. In the beginning it is sympathetic only, and in that respect resembles the vomiting which attends many other affections not necessarily involving the gastro-intestinal tract. After a while, however, in most if not all cases, it owns a more direct cause. The bowels above the seat of obstruction become distended with contents, partly with what has been taken by the mouth and has been transmitted onwards; partly, as Dr. Brinton justly insists, with the secretions of the intestinal walls; these, by the combined effects of simple overflow, of the peristaltic movements of the bowels and of the pressure exerted on the bowels from without, gain an entrance into the stomach, and then become vomited, constituting what is called stercoraceous vomit. The stercoraceous matter, though never in cases of simple obstruction derived from the large intestine, and probably never directly from the lower part of the small intestine, still acquires a thin pea-soup-like aspect and a fecal odor, which the normal contents of the stomach never do assume, and which are doubtless the result simply of the long residence of the intestinal contents within the bowels, and of their admixture there with bile and other secretions. Vomiting is generally an early symptom in all cases of intestinal obstruction, and in those of acute progress may continue to the end without intermission. Yet even in some of these it intermits, and may be absent for a comparatively long period. In the more chronic affections its occurrence is extremely variable; but even here vomiting generally becomes more or less constant, and then stercoraceous towards the close of life. There is no doubt that vomiting is an earlier, a less interrupted, and a more severe symptom, in proportion to the nearness of the seat of obstruction to the stomach, and that for this reason it is a more marked accompaniment of obstruction of the small intestine than of obstruction of the large.

(*c*) *Constipation* is naturally one of the most characteristic phenomena of obstructive disease, and its occurrence is of high diagnostic value; yet it need scarcely be repeated that fecal matters will often pass with comparatively little difficulty through even a tight stricture, especially one in the small intestine; nor must it be forgotten, that generally at the time at which complete obstruction is established, the bowel below contains a larger or smaller quantity of feces, which may be removed naturally or by injection, and the removal of which might lead to the belief that no obstruction exists. Scybala may sometimes be seen in the large intestine, after death from complete obstruction of the ileum of many weeks' standing. Nevertheless, constipation of an insuperable character is for the most part an exceedingly pronounced symptom; coming on suddenly, and persisting in cases of internal strangulation, and of the lodgment of gall-stones; coming on somewhat gradually, or at all events with premonitory stages, in most cases of stricture and of compression. In intussusception there is also generally sudden constipation, of various duration, but the invaginated mass (especially when the large intestine is involved) is rarely quite impervious, so that before long a slight transmission of fecal matter begins, at all events in all chronic cases, to take place; moreover, in cases of intussusception, blood is usually passed by stool at an early period, and more or less continuously throughout their whole duration.

The discharge, indeed, from the large intestine assumes something of a dysenteric character, and becomes associated with symptoms in some respects resembling those of dysentery. In intussusception of the small intestine, the discharge of blood is sometimes very copious.

(*d*) *Tumor and Shape of Belly.*—The belly in cases of obstruction soon becomes more or less tense and tympanitic (unless, indeed, the obstruction be in the upper part of the small intestine) in consequence of the distension of the bowel above the seat of stricture by accumulated fecal matters and by gas; and in some instances the shape which the abdomen then assumes may aid in the diagnosis of the site of obstruction. Thus, if the rectum were blocked up, distension, though soon extending throughout the whole of the large intestine, would first take place and be most extreme in the sigmoid flexure and descending colon, in the situation of which parts, therefore, some special fulness might be looked for; if the obstruction existed in the transverse colon, some fulness would not improbably be discovered in the right flank, and, according to circumstances, in the position of a larger or smaller portion of the transverse colon, the left flank presenting a comparative absence of fulness, tension, and even perhaps of weight; while, again, if the impediment occupied the lower part of the ileum, the distension would probably be most marked in the middle region of the abdomen. But, as has been before pointed out, the evidence afforded by the general shape, and resistance, and weight of the abdomen must be received with great caution, for the distended bowels very readily deviate from their usual position, and diffuse themselves, as it were, beneath the abdominal surface, displacing, or at least concealing the bowels, which are collapsed and empty. Sometimes, indeed, in distension of the large intestine, the sigmoid flexure extends over the whole front of the abdomen, and with the aid of the other lengths of colon effectually conceals the whole of the small intestine from observation. The presence of an abdominal tumor, as distinguished from mere distension of bowel, is an important element in diagnosis. It need scarcely be said that, in internal strangulation, and in most cases of compression, no tumor is likely to be felt; and indeed in stricture also, unless the stricture depend on some form of cancerous growth, or be associated with the presence of peritoneal cancer, or be in the rectum within reach of the finger, no tumor will probably be distinguished. In cases of lodgment of gall-stones, the lump produced by the presence of the gall-stone might, one should suppose, be not very difficult of detection; but unquestionably in the great majority of them, of those even under the care of thoroughly competent practitioners, no tumor has been recognized during life. Indeed it may be pretty confidently asserted that they are rarely, if ever, recognized. This fact may be due in some degree to the absence generally of very minute manual examination; but it must not be forgotten that the tumor formed by a gall-stone is really not very large, that the swelling of the bowel above the obstruction tends to cause the point of obstruction to recede from the surface, or to mask it, and that tenderness, abdominal fatness, rigidity of muscles, and other conditions, all aid more or less to interfere with successful manual examination. Of all the different forms of obstruction which have been enumerated, intussusception is the one which is most commonly attended with the presence of manifest tumor; but tumor seems to be far more common in connection with intussusception involving the large intestine than in that form of the disease which is limited to the ileum and jejunum. It is needless to repeat the characteristic features which such tumors present.

(*e*) *The Condition of the Urine* has been regarded, ever since Dr. Barlow's[1] interesting observations on the subject were published, as some indication either of the seat of obstruction, or of some other conditions connected with the obstruction. Dr. Barlow observed that, in a case of his, in which the obstruction was in the duodenum, there was an almost total suppression of urine; and there is no doubt that in many cases of obstruction high up, the same phenomena is manifested. He argued that the great diminution of this secretion, in his and in similar cases, was caused by the constant vomiting which is always present in obstruction of the upper part of the small intestine, and by the little available absorptive surface which is presented, combining to prevent the entrance of fluid into the vascular system, and the supply of an adequate amount to the kidneys for the maintenance of their secretion. And he argued further, that the abundant discharge of limpid urine which is frequently observed in cases where the seat of obstruction is low down, is to be explained by the presence of entirely opposite conditions. Further observation, however, seems to show that although there may be a tendency on the whole to a diminished secretion of urine when the impediment is high up, and to an increased, or at all events fairly abundant secretion when the impediment is low down, the urine is in many cases abundant or scanty apparently quite independently of the

[1] Guy's Hospital Reports, vol. ii. Second Series.

seat of obstruction.[1] Dr. Brinton, indeed, suggests that the diminished secretion of urine which is frequently met with, and the variability of which phenomenon he fully recognizes, is rather due to a kind of vicarious secretion into the bowel above the seat of obstruction, to which also, rather than to ingesta, he no doubt rightly attributes most of the distension of the bowel and much of the vomit. Mr. W. Sedgwick,[1] however, apparently with more reason, argues that the diminution or suppression of the urinary secretion is related to the suddenness and intensity of the symptoms, and is immediately due to the reflected influence of the abdominal sympathetic centres. On the whole, even if we adopt Mr. Sedgwick's views, it may probably be accepted as generally true that diminished secretion of urine—often, however, temporary—attends those cases in which the symptoms are of sudden occurrence and acute; and that a fairly abundant secretion of this fluid characterizes cases which are chronic in their course; and that, mainly on these very grounds, suppression or diminution of urine is far more common in cases in which the small intestine is obstructed, than in those in which the impediment occupies the larger bowel.

(*f*) *The Mode of Invasion* is often of great value in reference to diagnosis. Internal strangulation and intussusception always begin suddenly, with more or less acute and severe symptoms. Obstruction by gall-stones might be expected to be preceded by symptoms indicative of the passage of a gall-stone from the bladder into the duodenum, and by further symptoms arising in the course of its journey to the spot at which it becomes finally arrested; and sometimes, but by no means always, the history of such premonitory symptoms can be pretty clearly obtained. Stricture, on the other hand, and in a less marked degree obstruction from compression of the bowel, are in the great majority of cases preceded for a more or less considerable length of time by symptoms which point to what is going on, and which for the most part have a resemblance to those which attend the fatal attack.

(*g*) *The Duration of Life* after the commencement of symptoms which lead to belief in the presence of one of the maladies under consideration varies considerably in different cases. The continuance of life is compatible with the persistence of mere, though complete, colic or rectal obstruction of several weeks' or even months' duration. But death as a rule supervenes much earlier in proportion as the impediment is situated nearer to the stomach. When, however, enteritis is associated with obstruction, then, wherever the obstruction may be, the progress of the case is always very rapid, and, dating from the commencement of the enteritic symptoms, rarely occupies more than a week, often only three or four days. Hence internal strangulations, obstructions by gall-stones, and intussusceptions in which strangulation occurs (more particularly therefore intussusceptions of the small intestine), are usually fatal within a few days after the commencement of symptoms; while obstructions from stricture or compression, and generally also those from intussusception affecting the larger bowel, for the most part present a comparatively chronic progress.

(*h*) *Statistics.*—There are certain striking facts deducible from the statistics of obstructive diseases, which it is always well to bear in mind. First, as regards age and sex. It is a well-ascertained fact that obstruction by gall-stones always occurs late in life, generally over fifty, and about four times as frequently in women as in men; it appears also that intussusception may occur at all ages, and is at all ages somewhere about twice as common in males as in females, but that of intussusceptions involving the large intestine (which form pretty nearly two-thirds of the total number of fatal intussusceptions), probably fully one-half occur in children under seven years of age; it appears further that stricture (if we omit strictures due to congenital malformation) is a disease of adult life and occurs indifferently in both sexes. Next, in reference to the portion of intestine involved. Stricture, as a cause of death, belongs almost without exception to the large intestine, and not only so, but at least three-fourths of the total number of strictures are situated below the middle of the transverse colon; compression and traction belong essentially to the small intestine, and may be regarded, as Dr. Fagge observes, in a practical point of view as the strictures of that tract; internal strangulation occurs more particularly in connection with the small intestine, or with the cæcum and sigmoid flexure; gall-stones, with hardly an exception, become arrested somewhere in the jejunum or ileum; and the large intestine is involved in intussusception at least twice as often as the small intestine alone. Lastly, with respect to the relative frequency of the several lesions, it may be well to quote Dr. Brinton's figures, based on 500 deaths from obstruction; according to which it appears that out of 100 cases, 43 are cases of intussusception, 17 are cases of stricture, 4·8 are cases of impaction of gall-stones, 27·2 are cases of internal strangulation (including, however, all those cases which have been here described as compressions), and 8 are

[1] Med.-Chir. Trans. vol. li.

cases of torsion, in regard to which the opinion has been previously expressed that they are simply cases of uncomplicated enteritis.

(*i*) *Finally in respect of Treatment*, there are a few established principles which must guide us in all cases of sudden obstruction of the bowels, and especially in all cases where that sudden obstruction is attended with symptoms of enteritis. First, purgatives however mild can do no good, may do immense harm, and must be altogether discarded. Secondly, opiates and other sedatives must be administered largely, or at least sufficiently largely to produce some visible effect in relieving pain and giving rest, and should in most cases be administered by subcutaneous injection. Thirdly, but little food and stimulus should be administered by the mouth, for they are almost always immediately rejected, or if retained fail to be absorbed, and then add only to the bulk of fecal matters distending the bowel above the seat of obstruction, in either case adding to the patient's distress and tending to hasten death. Food given by the mouth should be in small quantities, fluid, and easy of absorption and digestion. There is no reason, however, in many cases, why we should not endeavor to support the patient's strength by nutritious enemata. Fourthly, operations for the relief of intestinal obstructions are rarely followed by satisfactory results; nevertheless, if there seem a chance, however remote, of lengthening the life of a patient who is otherwise doomed to speedy death, few would hesitate to catch at that chance. In some forms of obstruction an operation must from the very nature of things be at least useless, as for example in simple enteritis, in torsion, in most cases of compression of the bowel, and in the impaction of gallstones; but there can be no doubt that if an operation were performed at an early date, internal strangulations might be relieved with fair success, and intussusceptions might be retracted with frequent benefit. Dr. Fagge is doubtless judicious in recommending an operation for the retraction of ileo-cæcal intussusception, for reasons which have been given previously; and there can be no doubt that if the evidence points at all strongly to internal strangulation, an early resort to surgery should be had. It need scarcely be insisted on that no patient suffering from sudden obstruction with enteritic symptoms, in whom an external hernia, whether strangulated or not, exists or has existed, should be allowed to die without undergoing an exploratory operation at the seat of hernia.

[The importance of this subject justifies some further remarks upon it. Nothing is more likely to cause anxiety and embarrassment in practice, especially to the young practitioner, than intestinal Obstruction. How, for example, is one, at an early stage of experience, to act upon the injunction above given, that "purgatives, however mild," "must be altogether discarded?" An American authority, Dr. Flint,[1] puts the precept, if possible, yet more strongly: "A good practical rule, in all cases of abdominal pain, is to avoid purgative remedies until the character of the affection is determined." Yet the necessity of qualifying this direction is shown by the same author subsequently,[2] where, in considering Obstruction of the Bowels, he says: "The first point in the diagnosis is to determine whether there be anything more than functional constipation. If the latter only exist, the judicious employment of cathartics or enemas will be likely to procure complete relief." Again, under "Fecal Tumors": "Physicians of large experience have met with cases in which, after careful examination, they are in doubt, or, if they venture a decided opinion, it has proved erroneous. It is therefore a prudential rule to await the effect of measures of treatment based on the supposition that the tumor is fecal, before committing the judgment decisively." In regard to the treatment of Obstruction without strangulation, Dr. Flint observes that, besides giving only liquid food, "laxative medicines are indicated. The salines are in general to be preferred." "All active cathartics are contraindicated." Castor oil is recommended, in small doses repeated at intervals of several hours.

In this last discrimination, between *laxatives* and *active cathartics*, we may find sound practical ground to stand and act upon. It will never do to withhold opening medicines in all cases of abdominal pain, for fear they may turn out to be cases of insuperable mechanical obstruction. For, it is to be recollected that functional constipation, with colic, is extremely common; while Obstruction of the Bowels is comparatively infrequent, even during infancy and childhood. In adult patients, the presumption is, generally, that we have to deal only with functional constipation, even when this has proved obstinate. Moreover, prolonged, unrelieved constipation may produce or amount to "fecal impaction," recognized as one form of Obstruction, with all the dangers of enteritis, ulceration, perforation, peritonitis, and fatal collapse. Therefore we must be careful not to be led to neglect proper measures for the relief of prolonged constipation, by a premature *hypothesis* of mechanical obstruction, in the absence of its diagnostic signs. I re-

[1] Clinical Medicine, p. 324.]
[2] Ibid., pp. 326, 328, 329.]

member, for example, being called in consultation to the case of a young girl, whose symptoms had induced her attending physician to apprehend intestinal obstruction. She had been constipated for several days, with pain, nausea, general distress, tumefaction, and a tendency to prostration. A full draught of the effervescing solution of citrate of magnesium brought on free evacuation of the bowels, followed at once by relief and recovery.

Drastic cathartics (such as croton oil, elaterium, colocynth, &c.) ought always to be avoided in such cases. In constipation, moreover, where there is any room for suspicion of either form of Obstruction of the Bowels, even mild purgatives should be employed carefully, in moderate doses. Enemata are more generally allowed or approved. But it seems not inappropriate to cite here one more authority. Jonathan Hutchinson, in an admirable paper[1] upon Obstruction, says: "Saline laxatives are admissible in certain cases where impaction of feces is suspected, and in cases of stricture where fluidity of feces is desirable."

When the diagnosis of strangulation or intussusception has been clearly made out, the considerations set forth in the above article apply in force, and all medicines promotive of intestinal peristaltic movement are to be withheld.

Opium is here, no doubt, the "sheet anchor." Yet it may be abused. Sometimes it *masks* the symptoms, producing a delusive appearance of relief, while the evil is progressing beyond the time for remedial action.

Overdosing should then be guarded against, and no more should be given than suffices to alleviate pain, and maintain tranquillity. When fecal impaction has been diagnosticated, strychnia and belladonna are advised by some authorities: *e. g.*, a pill containing $\frac{1}{30}$ grain of sulphate of strychnia and $\frac{1}{250}$ of sulphate of atropia, every five or six hours.

Electricity (chiefly the continuous current) has been employed latterly in France, with reported success, in intestinal Obstruction. Amongst those who have narrated instances of its use are Czernicki,[2] Moutier,[3] Caubet,[4] Bucquoy,[5] and Doyen.[6]

The following Table (see next page), from Bryant,[7] may prove serviceable in regard to the diagnosis of different forms of Obstruction of the Bowels.

In examination of the abdomen for diagnosis, when Obstruction is suspected, *anæsthesia* should generally be resorted to. This prevents reflex rigidity of the muscles upon palpation; by which, especially when there is much tenderness on pressure, inspection of the abdomen is greatly interfered with. The "sausage-like" tumor of intussusception may, with the aid of etherization, be much more readily discovered; although its discrimination from impacted feces, &c., may require care. Anæsthesia also, by the relaxation it produces, essentially promotes the success of *abdominal taxis*. Efforts at reduction of a strangulated or invaginated gut by manipulation are recommended and practised by nearly all surgeons. Of course gentleness and tact are required for this procedure. An important addition to it may, in my belief, be obtained by *abdominal traction*. Although no reference to this has come to my knowledge in modern medical literature, it appears to have been once in use. Hallier,[1] in his Anatomical Disputations, mentions the employment by the celebrated Nuck, in a case of intussusception, of "huge cups to the abdomen." An apparatus lately devised by me for promoting artificial diaphragmatic respiration, by abdominal traction, awaits trial for this use also; no opportunity having as yet occurred for it.[2]

In regard to exploratory operations, before a diagnosis has been made, Jonathan Hutchinson[3] asserts that they are not warrantable; although he entirely approves of colotomy and enterotomy in appropriate cases whose nature has been diagnosticated. Teale,[4] however, Bryant,[5] Ashhurst,[6] and others, are prepared for *laparotomy* in cases not yielding to other treatment, even while the diagnosis is doubtful. Dr. Bristowe has very properly emphasized the argument upon this question connected with the not rare occurrence of recovery after the sloughing and removal of the invaginated gut, espe-

[1 Brit. Med. Journal, Aug. 31, 1878.]

[2 Réc. et Mém. de Méd. Milit., Paris, 1878, p. 406.]

[3 Année Méd. Caen, 1878–9, iv. p. 153.]

[4 Brochure, Toulouse, 1879.]

[5 Bull. et Mém. de la Soc. de Thérapeutique, 1879, p. 19.]

[6 Union Méd. et Scient. du Nordest, Reims, 1879, iii. p. 242.]

[7 Practice of Surgery, Amer. ed. p. 445.]

[1 Disputa. Anatom. Select., vol. vii. p. 126. Gottingæ, 1751. Quoted by Ashhurst, Am. Journ. of Med. Sciences, July, 1874.]

[2 This instrument consists of a brass pump, about two inches in diameter, attached to the perforated bottom of a copper pan, which is six inches across at its margin. When applied to the abdomen, this may be made to produce powerful traction, entirely under the control of the operator.]

[3 Brit. Med. Journal, Aug. 31, 1878.]

[4 Brit. Med. Journal, Jan. 11, 1879, p. 41.]

[5 Practice of Surgery, Am. edition, p. 454.]

[6 Amer. Journal of Med. Sciences, July, 1874, pp. 48 and 285.]

Diagnosis in Cases of Abdominal Obstruction.

	Acute—	Chronic Obstruction.		Acute or Chronic—
	Obstruction or Strangulation.	From Disease of Large Intestine.	From Disease of Small Intestine.	Intussusception.
Previous condition of subject.	In good health.	Ailing for some time with abdominal symptoms.	Ailing, with previous attacks or incomplete obstruction.	In good health.
Mode of attack.	Very sudden and acute.	Symptoms gradually increasing in severity, or acute grafted upon old.	Paroxysms of colicky pain, upon old symptoms.	Sudden onset, and increasing when acute, subsiding when chronic.
Early symptoms—				
Pain	*Abdominal pain*—fixed, central, and paroxysmal.	*Pain* diffused and increasing with distension.	*Pain*—paroxysmal, with intervals of ease, and hypogastric.	*Pain* fixed and often relieved by pressure.
Vomiting . .	*Vomiting* rapidly becoming fecal.	Intermittent and fecal towards the last.	Occasional during attack of pain.	Rapidly becoming fecal, in acute cases absent or intermittent in chronic.
Collapse . . .	*Collapse* very marked.	Absent till the end.	Absent till late.	Very marked in acute cases, not so in chronic.
Constipation .	Absolute constipation and inability to pass flatus.	Gradually increasing in severity.	Attacks of constipation, alternating with natural relief.	Occasionally present, but, as a rule, "dysenteric" symptoms, straining, tenesmus, muco-sanguineous stools, or hemorrhage.
Abdominal distension.	Rapid and severe, central and hypogastric.	Gradually increasing, lumbar and epigastric.	Never great, increased during attack.	Rarely severe.
Manipular indications.	Tympanitic, distended coils at times to be felt.	A fixed swelling at times to be felt in either iliac fossa.	A doughy condition of bowel, becoming knotty during attack.	Distinct tumor often to be felt, its shape varying during attack.
Visible indications.	Abdomen tense in umbilical and hypogastric regions, with visibly distended coils.	Abdomen bloadly distended, coils of intestine visible.	Coils of intestine very visible.	Nothing marked to be seen.
Peristalsis . .	Rarely visible.	Marked.	Very marked.	Not visible.
Urine	Scanty or suppressed	Natural in quantity.	Natural.	Natural.
Rectal examination,	Lower bowel probably quite empty.	Stricture of bowel may be felt in rectum or in sigmoid flexure by manual examination.	Nothing abnormal.	Rectum may contain mucus or invaginated bowel.

cially when the small intestine has been the seat of intussusception. Leichtenstern reported that, of 557 cases, sloughing occurred in 149, of whom 88 recovered; no sloughing in 408, of whom 63 recovered; making a mortality in all these cases, treated without operation, of 406, or 73 per cent. Ashhurst[1] shows that of 14 operations of laparotomy for intussusception, 5 ended in recovery, and of 60 cases of the same operation for other occasions 19 recovered; making in all 74 operations with 24 recoveries and 50 deaths,—a mortality of 67·57 per cent. These results, along with the now familiar frequent success of ovariotomy, in which the peritoneum is freely divided, seem to favor lessening the period of delay before operation, at least in cases of *acute* Obstruction. Laparotomy[1] consists in making an opening in the median line below the umbilicus, so as to allow of exploration, and, when practicable, removal of any existing obstruction.—H.]

[1 Loc. citat. For statistics of lumbar colotomy and its results, see an elaborate article by Prof. Erskine Mason, Am. Journal of Med. Sciences, October, 1873.]

[1 From λαπαρα, the soft part of the body below the ribs. Since the above was written, I have read an article by Dr. F. H. Hamilton (Hospital Gazette, New York, Jan. 3, 1880, p. 5), in which he advises *posture* (elevating the hips) as aiding in the relief of Obstruction of the Bowels.]

ULCERATION OF THE BOWELS.

By John Syer Bristowe, M.D., F.R.C.P.

Ulceration of the bowels, using the word in its widest sense to indicate all those cases in which the mucous membrane is partially—no matter how or why—destroyed, is a lesion of very common occurrence, sometimes induced by the extension of disease from the exterior of the intestine, more commonly the result of morbid processes commencing in its mucous and sub-mucous tissues.

I. Pathology.—(*a*) *Ulceration beginning from within.*—Ulceration which originates in connection with the mucous membrane may be found at any part of the intestinal tract; but there are certain situations in which it is met with much more frequently than elsewhere: these are the duodenum, the ileum (especially towards its outlet), the cæcum, ascending colon, sigmoid flexure and rectum; in other words, the commencement and the termination of both the larger and the smaller bowel.

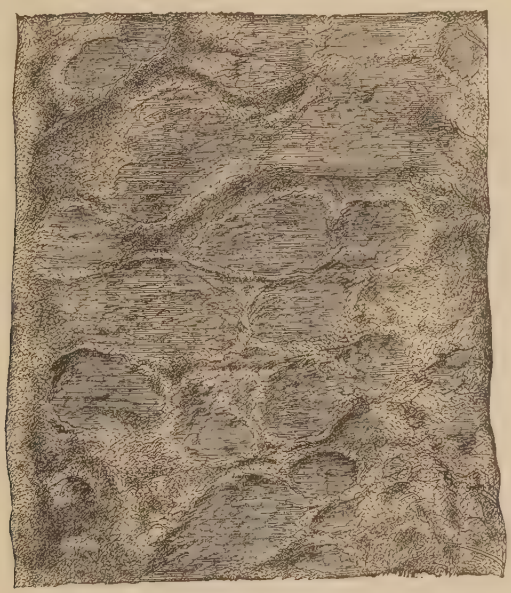
The causes of ulceration are very various, and are not always easy to define, and still less easy in practice to recognize. Some forms of it are no doubt distinctly the result of the liquefaction or destruction of some specific deposit, as in enteric fever and in tuberculosis, and, perhaps, in the latter stages of syphilis; and some, as possibly the dysenteric, are due to some specific kind of inflammation. But in a considerable number of cases the causes of ulceration are local; the bowel is wounded by some sharp body which has been swallowed, or is rubbed and irritated by some partially arrested solid mass, or is fretted by the constant passage over it of acrid fluids, or presents some localized point or points of inflammation, which own no more manifest cause than does a pustule of impetigo, a bleb of pemphigus, or an ordinary boil. It may, however, be conceded, that even in these latter cases the general condition of the patient has often much to do, at all events indirectly, with the production of the ulceration; that, for example, on the one hand the fluids which irritate are often irritating in consequence of being unhealthy; and, on the other hand, the fretted bowel often inflames or ulcerates under their influence, because it was previously congested, or its circulation was sluggish.

Many forms of inflammation of the skin are attended with an excessive production of epidermis, or with the exudation of matter into or beneath the epidermis, and thus become characterized by the development of squamæ or of crusts, on the removal of which a more or less raw surface is left, and beneath which ulceration is apt to take place. The varieties of cutaneous inflammation, here very briefly indicated, are for the most part easy of separate recognition, yet they not infrequently merge one into the other. But on mucous surfaces the distinctions between scaly, vesicular, and even pustular affections are rarely, if ever, very obvious, the delicacy and moisture of the epithelium interfering alike with the formation of a mere dry scale and with the limited accumulation of fluid beneath it. I have used the term "croupous" on another page, to indicate those forms of intestinal inflammation in which the mucous membrane is found covered with an opaque adherent film, composed of corpuscular elements, derived partly from its surface, partly from its glandular involutions; but I have used it in no specific sense, and believe that, in many cases at least, the film, or false membrane, is homologous with the scurf of pityriasis, the scales of lepra, or the vesicles of eczema. Ulceration of the bowels not infrequently commences with "croupous" inflammation: a linear or irregularly polygonal or stellate patch of more or less intense congestion and tumefaction makes its appearance, which soon becomes covered (excepting, perhaps, at the edges by which it may be extending) with an opaque whitish or buff-colored exudation, which is somewhat friable and granular on the surface, and extends by rootlets into the Lieberkühnian follicles; the patch of exudation after a time separates, and leaves sometimes a sound surface, sometimes a slight excoriation, or even a distinct ulcer, manifested by a somewhat cupped grayish or yellowish surface and a well-marked margin of congested mucous membrane. Ulcers commencing thus may be met with in any part of the bowels, but are much more common in the large intestine than elsewhere. In the small intestine they chiefly affect the free edges of the valvulæ conniventes, and in the large intestine either the projecting ridges formed by the intervals between the sacculi, or those which correspond to the longitudinal mus-

cular bands. They are very apt to occur, particularly in the large intestine, in the course of pneumonia, and in cases in which the patient is dying from many forms of chronic disease, such as Bright's disease of the kidneys, cirrhosis, cancer, chronic phthisis; and, from the peculiar position which they occupy, there is reason to believe that they depend, partly at least, on irritation by the intestinal contents. Occasionally we find large tracts of bowel more or less deeply congested, and studded with irregular patches or bands, or an imperfect network, consisting partly of croupous exudation, partly of consecutive ulceration.

In other cases ulceration commences either from distinct mechanical injury or from more gradual erosion; the ulcer then being roundish, or more or less irregular in form, varies in size, presenting a more or less congested and well-defined, but not necessarily thickened, margin, and a more or less irregularly excavated shreddy grayish surface. Such ulcers may be observed when gall-stones or other solid bodies have lain for some time in contact with a portion of intestinal surface; they occur also in the large intestine, when it has been long distended with accumulated fecal contents. In several cases of long-continued constipation, I have seen the mucous surface of the larger bowel studded with tracts varying from about one to twelve square inches in area, consisting of groups of circular ulcers of the kind now under consideration from half an inch downwards in diameter, and separated from one another by a network formed of congested and partly undermined bands of mucous membrane.

[Fig. 10.



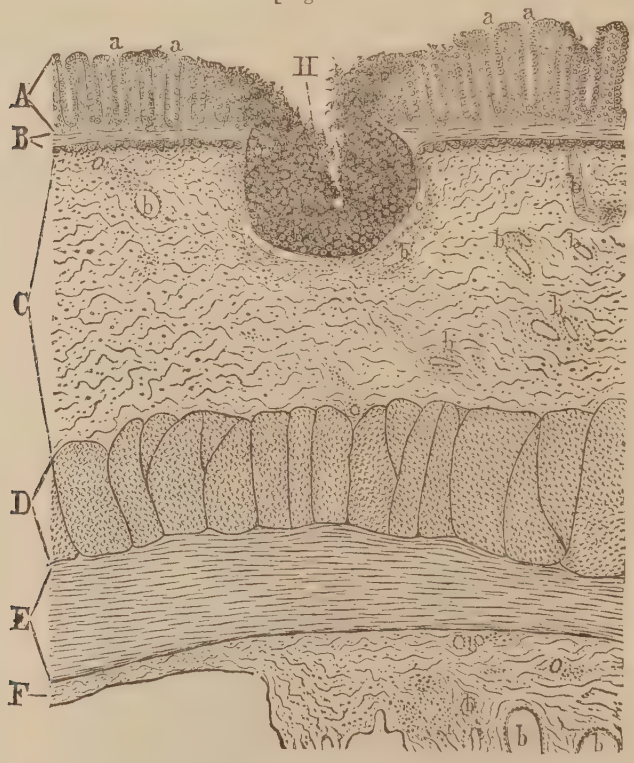
Descending Colon, with oval Ulcers. (From a photomicrograph by Surgeon J. J. Woodward, U. S. Army. Copied from the Second Medical Volume of the Medical and Surgical History of the War of the Rebellion.)]

Sometimes, again, ulcers obviously originate in patches of sub-mucous suppuration, as we see occasionally in pyæmia, or in patches of sub-mucous slough, like an ordinary furuncle. Among these may, perhaps, be reckoned the ulcerative inflammation of the follicles of the colon, which Rokitansky describes, and which seems by many to be considered the earliest stage of dysentery. The follicles first enlarge to between the size of a tare and a pea, and become surrounded by a dark red halo of congestion, and then, undergoing suppuration, discharge their contents into the bowel by an ulcerated opening, which eventually enlarges, and forms a circular ulcer with overlapping edges. When the follicles are widely affected, the mucous membrane presents in the first instance a generally congested tuberculated surface, upon which, after a short time, groups of small tolerably deep circular ulcers make their appearance.

In other cases, again, ulceration is produced by the separation of a slough. In various parts of the small intestine, but perhaps most commonly in the duodenum and jejunum, as well also as in the œsoph-

agus and stomach, circumscribed patches of intense congestion or of extravasation of blood appear in the substance of the mucous membrane, the patches shortly dying, and coming away either bit by bit or in mass. The formation and separation of such patches are often effected with little obvious change in the parts immediately surrounding them; there is often no unwonted congestion observable, and the pits which are formed by their removal for the most part speedily become effaced. I believe they are most commonly seen in cases of smallpox, typhus, and other such diseases. A somewhat similar condition is sometimes observed in the valvulæ conniventes, and still more frequently in the transverse projections from the interior of the larger intestine, the free edges of which then

[Fig. 11.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of healing, we find the general surface smooth and clean, or it may be granulating, the edges little if at all thickened or congested, perhaps puckered, and sloping more or less obviously to the surface of the ulcer with which they are continuous; when they are sluggish, the edges are more or less tumid and rounded, and it may be overhanging, and the general surface smooth, or somewhat irregular and flocculent; and again, when they are spreading, the surrounding mucous membrane presents more or less intense congestion and swelling, and the immediate edge of the ulcer is either flocculent and ash-colored, or presents a vivid red, raw, bleeding wall, or forms a more or less complete rim of distinct gangrene. The floor of an intestinal ulcer is generally constituted by the sub-mucous tissue, but not infrequently the transverse muscular fibres are distinctly exposed, especially in an ulcer which is still spreading; and when the ulcer tends to perforate the bowel the muscular coat itself becomes opaque, eroded, and in parts destroyed.

The account just given applies to individual ulcers. But very frequently, and much more frequently in the large than in the small intestine, numerous ulcers are present at the same time, and tend to increase either in number or size and to coalesce in a greater or less degree; and then, according to the stage to which the ulceration has advanced, we meet in different cases with either a number of roundish ulcers separated by an imperfect network of mucous membrane, or interlacing networks of ulceration and of mucous membrane, or islets of mucous membrane in an expanse of ulceration; or lastly, extensive tracts from which the mucous coat has been wholly removed. In these cases the transverse muscular fibres are often freely exposed, and the remains of mucous membrane are red and swollen and rounded, and form tubercular excrescences. The bowel, moreover, is frequently much contracted.

Some of the specific forms of intestinal ulceration have been elsewhere considered. There is only one, indeed, tubercular ulceration which needs anything like minute description here. Still it may be convenient briefly to advert to some of the more important features which do, or are supposed to, distinguish them severally. I am not aware that syphilitic ulceration has been surely recognized in the alimentary canal, except in the neighborhood of its inlet and outlet; intestinal ulceration, however, is often met with in persons who have died when under the influence of the syphilitic virus, and it seems at least reasonable to suppose that in some of these cases the ulceration, even though it presents no visible distinctive mark, owns a syphilitic origin. Dysenteric ulceration occupies the large intestine, and occasionally invades also the lower part of the ileum. The mode of origin of the tropical form of the disease is variously described; by many, including the late Dr. Baly, it is considered to arise in inflammation and suppuration of the solitary glands; by others it is believed to originate in a croupous form of inflammation; and no doubt it sometimes commences with intense general inflammation, passing at once into gangrene. But, however it may begin, it tends to the rapid destruction of extensive tracts of mucous membrane, and to that chronic condition of more or less extensive rawness which has been above referred to. In typhoid fever a deposit takes place in the solitary glands, and in Peyer's patches (more frequently in the latter than in the former), which become congested, softened, and form flat wheal-like elevations. At the end of a few days, it may be a week, the bulk of the enlarged gland begins to slough, a line of ulceration forms around the slough, and this latter acquires a peculiar yellow or brownish hue. In a short time the slough separates, leaving a circular or sinuous ulcer with congested tumid edges, and an excavated surface, limited either by the sub-mucous tissue or by the transverse muscular fibres. Then usually the edges begin to resume the normal thickness and color of mucous membrane, and to blend gradually with the contiguous surface of the ulcer, which itself fills up and contracts, and ultimately heals with a scarcely or not at all visible cicatrix. At other times the ulcer remains irritable or sluggish, or spreads both in surface and depth, either by gradual erosion, or by sloughing, or by the phagedænic process. And then sometimes hemorrhage, sometimes perforation of the bowel takes place. Typhoid ulcers vary in size from about that of a split pea to that of the largest of Peyer's patches. They are always most marked immediately above the ileo-cæcal valve (to which part they are sometimes limited), and extend thence, gradually decreasing in number and size, upwards through the ileum and occasionally the jejunum. They occur in the large intestine in about half the total number of cases, being then of smaller size than those in the ileum, and diminishing in number from the cæcum downwards.

Tubercular disease of the mucous membrane of the bowel is one of the most frequent forms in which the tubercular diathesis reveals itself, and certainly the most frequent cause of intestinal ulceration. It occurs in rather more than one-half of the total number of cases of pulmonary consumption, and rarely, if ever, independently of it; and it is often associated with peritoneal and other varieties

of abdominal tubercle. It affects primarily the same structures as are affected in enteric fever, namely, Peyer's patches and the solitary glands; and in the small intestine therefore is always most advanced and most abundant immediately above the ileo-cæcal valve, from whence upwards (although it may extend throughout the ileum and jejunum) it gradually diminishes. It affects the cæcum more than any other part of the large intestine, involving also the ileo-cæcal valve and the vermiform appendage; but it may form patches throughout the whole of the colon. The large intestine and small intestine are affected by it with equal frequency, and they are both affected in combination about twice as frequently as they are each affected separately. The tubercular material is deposited, either in the form of gray granules or of yellow cheesy masses, in the substance of the congested and swollen glands, and generally soon undergoes softening, producing a small pretty deep ulcer with thickened elevated overhanging edges. When several of these deposits have softened side by side, as happens in Peyer's patches, the ulcerated area presents in the first instance a kind of honeycombed appearance, the small ulcers being separated by more or less complete bridles of yet undestroyed and thickened mucous membrane, and the general margin, which is also thickened, presents a sinuous or scolloped outline. Tubercular ulcers generally tend to spread by the successive deposition and softening of tubercles at their edges, the tubercles not being then necessarily limited to the glands; and by this process they often extend over a considerable area. In the large intestine the whole mucous membrane of the cæcum is sometimes thus destroyed, and often very extensive tracts of ulceration are found to stud the surface of the colon at more or less distant intervals. In the small intestine tubercular ulceration has a remarkable tendency to spread in the transverse direction, and frequently forms bands from half an inch to an inch or more wide, occupying the whole circumference of the bowel. Many of these are sometimes met with at short distances from one another throughout the greater part of the small intestine. In most cases the ulcers still go on enlarging up to the patient's death, and occasionally they lead to hemorrhage or to perforation. Sometimes, however, they cicatrize more or less perfectly: some cicatrizing, indeed, while others are spreading or new ones are forming. But, owing to the extensive destruction which tubercular ulceration occasions, cicatrization is generally attended with considerable contraction; so that sometimes in the small intestine, in the cæcum, or in the colon, the calibre of the bowel becomes in consequence so much diminished as to produce a real stricture. Sometimes, again, tubercular deposits dry up or become absorbed without ever undergoing actual ulceration; and it is not a rare thing to find, in cases of chronic phthisis, both in the large and small intestines, small, irregular elevated patches, sometimes associated with ulceration or the remains of ulceration, which present a dark grayish hue and a cicatrix-like appearance, the surface being studded with small granules, the edges being puckered and prolonged by irregular bands into the membrane around, an appearance having some resemblance to that produced by superficial lupus. The peritoneal surface corresponding to tubercular ulcers of the mucous membrane is generally studded with minute gray granulations and the lymphatics ramifying in the walls of the same part, and those extending between it and the nearest mesenteric glands are often filled with opaque white creamy or cheesy contents. It may be added that extensive chronic ulceration of the large intestine, which has all the characters previously described as belonging to the later stages of dysentery, or of non-specific forms of intestinal ulceration, is often met with in phthisical patients; in whom there is no tubercle in any part of the bowel except the ileum, and where therefore it may be a question whether the ulceration originated directly in the breaking down of tubercle, or whether, as seems most likely, it took its origin in simple excoriation caused by the constant passage of irritating secretions from the tubercular bowel above, just as the mucous membrane of the trachea becomes so often excoriated in the course of pulmonary phthisis.

Many intestinal ulcers doubtless cicatrize and leave behind them no traces of their former existence, or, at most, a smooth depression with puckered edges. In other cases, however, and indeed in a large proportion of them, results of more or less serious importance follow.

Sometimes, where a vast continuous extent of surface has been destroyed, as we see occasionally in the rectum and other parts of the large intestine, the mucous membrane never does become restored; and even in cases where the destruction of tissue has been much more limited, the ulcer may assume the character often presented by the chronic ulcer of the stomach, and be ready, as that is, to break out again and again under apparently the most trivial provocation. But generally when a large ulcer heals wholly or in part, some degree of contraction of the calibre of the bowel is the consequence—contraction which takes place both in length and in breadth, but which from obvious causes manifests itself most

conspicuously in the latter direction. Stricture, in fact, often follows such contraction, but especially, and indeed almost exclusively, when the ulceration which has given rise to it has occupied the whole circumference of the bowel, as it does often in tubercular disease, and always after the separation of a mass of invaginated bowel.

[Fig. 12.

Tubercular Girdle-sore, natural size. (From a photomicrograph by Surgeon J. J. Woodward, U. S. Army. Copied from the Second Medical Volume of the Medical and Surgical History of the War of the Rebellion.)]

Another very common sequence of ulceration is perforation of the intestinal walls at the seat of ulceration, and the consequent communication of the interior of the bowel either with the peritoneal cavity, or with that of some hollow viscus. The most frequent of these communications is that with the peritoneum. Perforation occurs more frequently in enteric fever than in any other kind of disease, taking place generally somewhere in the lower three feet of the ileum, and rarely in the colon. It occurs occasionally only in the course of tubercular ulceration of the bowel, and then also generally in the lower part of the ileum. It is induced sometimes by the constant fretting kept up by the pressure of some hard irritating body, such as a gall-stone or some other form of intestinal concretion. Sometimes it follows upon the ulceration and softening of the mucous membrane, which attend the undue distension taking place often in the bowel above an impediment. Sometimes, again, it results from the separation of freshly united surfaces, as in intussusception. And indeed it may happen in the course of any form of ulceration, or weakness, whether dependent on mere thinning, or softening, or ulceration, or gangrene. The actual perforation, at least so far as regards the peritoneum, which is always the last part to yield, is due generally, perhaps always, to laceration. And although the result of the lesion is general and, with few exceptions, rapidly fatal peritonitis, the lips of the perforation and the contiguous portion of bowel are almost always found adherent by lymph to some neighboring viscus. Indeed perforation into the peritoneum is sometimes staved off, or wholly prevented, by the previous occurrence of localized adhesive peritonitis. It is by the intervention of such adhesion that a perforating ulcer of the bowel comes usually to communicate with some neighboring hollow viscus. The ulcer, having first eaten its way through the thickness of the parietes of the bowel, next perforates the layer of adhesions, then the walls of the attached viscus; and thus establishes a more or less free passage between them, and permits a more or less ready interchange of contents. Sometimes an abscess-like cavity lies between the two organs which communicate, and forms the medium of their communication. Such communications, though generally perhaps permanent, are not always so; and their closure is effected usually by the retreat of the bowel from the organ to which it is adherent, and the consequent formation of a hollow funnel-like passage between them, which becoming longer and narrower, finally closes at its narrowest end, or that furthest from the bowel. There are probably none of the abdominal viscera between which and the bowels communication may not be established by means of ulceration beginning on the side of the bowel. Thus, not infrequently,

[Fig. 13.

Small Tubercular Ulcers in a Peyer's Patch, natural size. (From a photomicrograph by Surgeon J. J. Woodward, U. S. Army. Copied from the Second Medical Volume of the Medical and Surgical History of the War of the Rebellion.)]

contiguous portions of the small intestine are found opening into one another, or small intestine into the transverse or some other part of the colon: and thus the rectum or sigmoid flexure, or even the small intestine, may be found to communicate with an ovary or with the urinary bladder; or the duodenum, and perhaps the transverse colon with the gall-bladder; or the stomach with the transverse colon; or again almost any part of the intestinal canal may open through the abdominal parietes, forming a fecal fistula, or artificial anus. In some cases the perforating ulceration begins in a diverticulum of the ileum, or in one of the false diverticula occurring sometimes in the large intestine. Mr. Sydney Jones[1] records a case in which ulceration of a false diverticulum in the sigmoid flexure led to a passage between that part of the

[Fig. 14.

Section through the lumen of a Lymphatic in the Submucosa of the Ileum. Magnified 480 diameters. *a*, granular fibrin-clot. *b*, *b*, loosened endothelial elements. (From a photomicrograph by Surgeon J. J. Woodward, U. S. Army. Copied from the Second Medical Volume of the Medical and Surgical History of the War of the Rebellion.)]

bowel and the bladder. The results of some of these communications are perhaps of little importance; other communications, however, are not only of dangerous consequence, but also of much interest. Among these latter are especially communications between the colon and the stomach or duodenum, which lead to the occasional or constant vomiting of actual feces, and the escape of undigested food into the large intestine; and communications with the urinary bladder, which occasion the escape of flatus and of feces into that viscus, with other consequences which are easy to foresee.

[The insertion of the above illustration in this place (Fig. 14) has, especially, a retrospective purpose, in connection with the general pathology of tubercle. (See articles on SCROFULA, Vol. I., and PHTHISIS, Vol. II.) Since the beginning of the present year there has been published an important and instructive volume (Vol. I. of Part II.) of the Medical History of the War, by Surgeon J. J. Woodward, U. S. A.[1] This contains, in the course of an elaborate discussion of Tubercular Ulceration of the Intestines, an account of Dr. Woodward's most recent investigations, with ample materials, into the histology of tubercle.

After referring to the opinion of Virchow, Hering, and Klebs, that the "giant cells" of tuberculous formations originate in the swollen endothelium of small lymphatic vessels, and that of Schüppel, Brodowski, Cornil, and Ranvier, that they have their origin in the interior of small bloodvessels, Dr. Woodward thus expresses his conclusions, derived from his own observations:—

"I incline to interpret, with Virchow, the central figure as a lymphatic vessel cut across, rather than with Cornil and Ranvier as a bloodvessel." "A larger fibrin-clot, completely filling the vessel and entangling similar elements in its interior forms, I suppose, the round or oval figure seen in the centre of the young tubercle granulation. (See *a*, Fig. 14.) It is easy to understand that some of these figures, if shrunken by the more potent influence of chromic acid hardening instead of being hardened by alcohol alone, would bear a striking resemblance to the descriptions of giant-cells." "I incline, therefore, to regard the so-called giant-cells, in intestinal and peritoneal tubercles, as figures resulting from the action of chromic acid on sections of lymphatic vessels stuffed with coagulated fibrin. The large endothelioid elements of the primary tubercle-granulation outside its central figure, I suppose to be formed by mere enlargement of the endothelial elements of the lymph spaces in the connective tissue. These elements are not always limited to the tubercle-granulations. In several specimens in which the tubercle-formation was accompanied by a protracted intestinal catarrh I have found them in all parts of the *submucosa*." "If the foregoing descriptions are substantially correct, the development of the ultimate tubercle-granulation would seem

[1] Path. Trans. vol. x.

[1] Washington, Government Printing Office, 1879. See in that work p. 593 et seq.]

to be determined by the formation of a fibrin-clot obstructing a small lymphatic vessel. Around the vessel, at the point of obstruction, lymphoid cells accumulate in a group. According to this view the lymphoid cells are to be regarded as representing probably a swarm of migrated white corpuscles, while the large endothelioid elements are produced by the gradual enlargement of the fixed corpuscles of the area of connective tissue involved."[1]—H.]

(*b*) *Ulceration beginning from without.*—Ulceration of the bowel beginning from without occurs generally in connection with some abscess of which the intestine has been made to form a portion of the parietes. The abscess is sometimes distinctly peritoneal; sometimes occupies a viscus which becomes adherent to the bowel at the point where perforation is about to take place. Sometimes the purulent matter infiltrates the cellular tissue of the mesentery or of some other peritoneal duplicature, and thus reaches the intestinal walls. If the external abscess attacks a part of bowel covered with peritoneum, it generally causes the erosion of that membrane in the first instance to a comparatively small extent: then the matter undermines it, and accumulates between it and the muscular coat; soon the muscular coat becomes opaque, softened, and perforated in one or more spots, when again an accumulation of matter takes place between the muscular and the mucous membranes, which latter then forms a larger or smaller hemispherical bulging towards the interior of the bowel, on the convexity of which ulceration soon ensues, and the communication between the abscess and the bowel is completed. Or again, a hollow viscus may open by ulceration into the bowel, having first caused adhesion, exactly in the same way that the bowel opens into other organs. By the processes here indicated, peritoneal abscesses discharge themselves into various parts of the bowel; inflamed ovarian tumors communicate with the rectum, sigmoid flexure, or other parts; an ulcerated gall-bladder, or an abscess of the liver, perforates the duodenum or transverse colon; an abscess of the kidney or other form of retro-peritoneal abscess opens on the one side into the ascending colon and cæcum, on the other into the descending colon, or, by burrowing beneath the peritoneum, reaches the rectum, and perforates that. In a similar way, too, an abscess of the liver, or even an empyema, may empty itself into the cæcum or some other part of the large intestine, in or just above the pelvis.

In a few instances, tubercular deposits commencing at the peritoneal surface gradually invade the whole thickness of the bowel, forming here and there large knots of tubercular infiltration of the intestinal walls, which gradually softening lead to the ulceration of the mucous surface over them, to the formation of a tubercular abscess, and even to a communication between the interior of the bowel and the cavity of the abdomen.

It may, perhaps, be added here, that malignant disease of the bowel not only causes ulceration of the mucous surface, but not infrequently produces perforation into the abdomen, and is, perhaps, the most frequent cause of complex and unusual communications between neighboring cavities, and these and the external surface.

II. SYMPTOMS.—*The symptoms* which ulceration of the bowels produces are so constantly associated with the symptoms of those morbid states of system on which the ulceration depends, and are so frequently mixed up with symptoms due to the various complications which follow upon ulceration, that we have seldom the opportunity of studying them in their simple form; and, indeed, if we omit all reference to the symptoms of its complications, we leave very little to be said upon the symptomatology of ulceration. It may be stated generally, that ulceration of the bowels is attended in the first instance with more or less marked febrile symptoms, which assume, if the disease become chronic, a distinctly and indeed typical hectic character; that the affected bowel is more or less tender on pressure, a character which is especially observable if the ulceration be extensive, or if it occupy the cæcum and other parts of the large intestine; that there is some impairment of nutrition marked by emaciation and debility, and feebleness of circulation; and that there is, above all, something abnormal in the action of the bowels and in the evacuations. The stools in ulceration of the bowels are generally liquid, contain an abnormal quantity of the fluid secretions of the bowels, and not infrequently more or less blood; they are, moreover, often pea-soup-like in color and consistence, and much more fetid than in health; further, they are usually passed much more frequently than natural, and the patient suffers from frequent colicky pains and from tenesmus. But all these symptoms are liable to much modification, and one or even all of them may be absent. Thus, sometimes ulceration is present, especially if it occur high up in the small intestine, without occasioning any obvious disturbance of the bowels. I recollect very well the case of a man who died from gradually increasing emaciation and debility, with no symptoms sufficiently characteristic to point to any one organ

[1] Op. citat. pp. 594, 595.]

as the seat of the disease, and in whom after death the only visible lesion was pretty extensive chronic ulceration of the upper part of the ileum. The bowels, indeed, may be constipated from first to last, as we now and then observe in cases of enteric fever, and as happened in a case of extensive ulceration of the large intestine which I have quoted in another article, and in which death, and probably the ulceration itself, were due to simple constipation. Ulceration of the larger bowel is much more constantly associated with the passage of frequent and thin evacuations than is ulceration of the small intestine: these may be purely diarrhœal when the upper part of the large intestine is alone involved, but assume a more and more decidedly dysenteric character in proportion as the ulceration affects its lower part; in which latter condition the evacuations, though frequent and passed with extreme tenesmus, are scanty, mucous, and often sanguinolent, and occasionally only containing a little true fecal matter. It is in this dysenteric form of disease, moreover, that the evacuations become most offensive, the fœtor being sometimes, even though no gangrene be present, putrid, and almost insufferable. Besides the slight oozing of blood which tinges the evacuations in diarrhœa of a dysenteric character, hemorrhage to a considerable amount sometimes takes place, hemorrhage which may be continuous or recurrent, and sufficient in quantity to destroy life. This accident is not very infrequent either in enteric fever or dysentery, and occasionally results from the perforation of a comparatively large vein or artery. There is little to add, even in regard to the diarrhœa which attends tubercular disease of the bowels, excepting that as the intestinal disease is mostly a progressive one, the diarrhœal symptoms, having once declared themselves, tend to become progressively more and more severe, and that it is for the most part in those cases of phthisis which are attended with intestinal complication that the emaciation is most rapid and becomes most extreme. This is not the place to discuss the various symptoms which are caused by stricture, and by perforation of the bowel, and by the communication of the bowel with other organs, nor to enter upon the description of those symptoms which attend typhoid or dysenteric ulceration.

III. Treatment.—*The Treatment* of ulceration merges in the treatment of the various diseases with which it is connected, and admits, indeed, of but little independent remark. But putting all its complications out of the question, our aim in the treatment of ulceration would seem to be, first, to promote the healing of the ulcer, and to prevent, as far as possible, the local mischances which are apt to follow; second, to check the abdominal discomfort and the diarrhœa which so rapidly weaken the patient; and third, to support his strength directly by all means at our disposal. Whether there are any medicines which are capable of being made to act directly on an ulcer seated at a distance from either outlet may be a matter of doubt; still, from our knowledge of what drugs are useful in ulcers of the stomach and of the lower end of the large intestine, we are justified at least in hoping that some benefit, however infinitesimal, may result from the employment of the same medicines in the treatment of the deeper-seated disease. On these grounds, bismuth, nitrate of silver, iron, copper, the mineral acids and other remedies, have been frequently employed, and often with apparent benefit. But rest, which is so useful an adjunct in the treatment of so many diseases, is of inestimable value in the treatment of ulceration of the bowels. The violent and frequent peristaltic movements and writhings which the ulcers themselves give rise to, tend obviously to prevent them from healing, and add greatly to the danger of perforation; purgative medicines should therefore be entirely, or at least as much as possible, avoided, and further, the exalted peristaltic movements which attend the disease should be restrained. For this purpose various astringent medicines may be used—lime, tannic acid, chalk, and vegetable astringents; but far more useful than these, as a rule, is opium, in one or other of its various preparations. There are probably few simple combinations more generally useful than the aromatic powder of chalk and opium, and the compound kino powder. But it is well to bear in mind that opium cannot always be taken in these cases. Chronic ulceration of the bowels is often attended with an irritable condition of the mucous membrane of the mouth and stomach, manifested by dryness, soreness, and, perhaps, cracking of the tongue, and heat at the stomach, with nausea—conditions which the use of opium unfortunately often intensifies. If opium then cannot be administered, astringent medicines with carminatives must be alone employed; or some other form of sedative, such as hyoscyamus, belladonna, Indian hemp, hydrocyanic acid, &c., must be resorted to. Opium may often be given with advantage in the form of suppository or of enema. It need scarcely be added that it is never desirable by these means to produce prolonged constipation; and that to obviate this contingency, either the medicines which have produced it must be left off or given in diminished doses, or simple enemata must be em-

ployed. It is obvious that the various measures which have just been enumerated, while they check peristalsis, act with equal efficacy in fulfilling the second indication of treatment—namely, the arrest of diarrhœa. Our third and last object, the maintenance of the patient's strength, must be attained by the exhibition of tonic medicines, and the careful administration of food and stimulants. The form of tonic to be given must obviously be made to accord with the treatment selected to restrain peristalsis and diarrhœa; it must also be adapted to the condition of the patient, as regards his general health and his digestive functions. In the same way the diet must be regulated; nothing should be permitted which is known to disagree with the patient; everything should be well cooked, well masticated, and easy of digestion, and food should be given in moderate quantities, and at regular if not frequent intervals. Farinaceous foods are in many cases most suitable, but eggs, fish, and fowl may often be used with great advantage. Butchers' meat is sometimes wholly inadmissible. For stimulants, nothing, perhaps, is better, in a general way, than brandy and water, sherry, or madeira.

For reasons which are sufficiently apparent, and which have indeed been already indicated, the remarks on the treatment of ulceration are intentionally meagre, and point rather to general principles than to details.

CANCEROUS AND OTHER GROWTHS OF THE INTESTINES.

By John Syer Bristowe, M.D., F.R.C.P.

(1) *Cancerous disease*, to any serious extent, much more rarely affects the intestines than the stomach, and the small intestine much more rarely than the large. Of all parts of the intestinal canal, the rectum seems to be the most frequently thus affected, the sigmoid flexure next. Yet the bowels are very often the seat of a trivial amount of cancerous deposit; for peritoneal cancer, which is a not uncommon form of disease, is almost always attended with more or less involvement of their serous surface. Cancer rarely originates in the substance of the intestinal walls; but involves them by extension from the serous membrane, from the mesenteric and other abdominal lymphatic glands, from the connective tissue of the lesser omentum, venter ilei, or pelvis, or from the stomach, or the pelvic genito-urinary organs, especially the uterus and vagina. When commencing from the peritoneum, it makes its appearance in that membrane in the form of lenticular or tubercular elevations, which tend to increase in number and to enlarge, and then to coalesce, so as to form a tolerably smooth or somewhat nodulated lamina of various thickness. Generally the cancerous deposits appear first, and are most abundant in the vicinity of the lines along which the peritoneum leaves the bowel; and whether the disease begins in the peritoneum or in the substance of the mesentery and similar processes (but especially in the latter case), the sub-serous connective tissue becomes largely infiltrated and thickened, and the bowel firmly fixed to it or set as it were in it. It is naturally in the loose tissues around the lower part of the rectum, the cæcum, and the duodenum, that the development of sub-peritoneal cancer is most abundant; and sometimes these parts are thus reduced to mere channels, excavated, as it were, in the substance of a solid mass. Cancerous disease of the outer surface of the bowel may be almost universal; or it may affect tracts of bowel of various lengths; or, again, a band of cancerous deposit may encircle the bowel at some point (generally, in this case, the lower part of the large intestine), while merely a few isolated cancerous nodules are scattered at distant intervals over other parts of the peritoneum.

Cancer beginning on the outer surface tends no doubt, sooner or later, to invade the tissues internal to it; but although there is certainly a great tendency in it to spread laterally, it is remarkable how frequently, even in extensive peritoneal cancer, the muscular and mucous coats escape. When the disease extends inwards, growths of cancer, continuous with those placed externally, perforate the muscular coat, which generally becomes at the same time increased in thickness

and marked with vertical bands, of which some appear to be simply fibrous. Subsequently the disease invades the submucous tissue, in which it spreads both laterally and vertically, forming a more or less well-defined, rounded, or nodulated tumor, at first beneath the mucous membrane which is still movable over it, then involving that membrane, and rendering it smooth and fixed. At this stage nodules of cancer, having no apparent continuity with pre-existing cancerous masses, are apt to appear in the substance of the mucous membrane. Then soon ulceration takes place, which is sometimes preceded by the formation of a kind of false membrane on the diseased surface, and is often attended with more or less sloughing of the cancerous mass. The diseased tract thus becomes excavated, and then presents either a hard, smooth, cupped surface, or one in which fungous granulations are intermixed with sloughing hollows; the edges being thickened, and either callous and tolerably smooth, or sprouting out with cancerous excrescences.

The direct ill-effects of cancer of the bowels are various. In some cases, especially when the mucous membrane is involved in some considerable area, diarrhœa of a more or less uncontrollable character contributes to hasten the patient's death; in other cases, and generally when the large intestine is the seat of disease, and a limited portion of bowel only is involved, stricture takes place; in other cases, serious or fatal hemorrhage arises, either from the general surface of an ulcer, or in consequence of the erosion of some large vessel in the progress of the ulceration; and in other cases, again, the bowel opens into the peritoneum, and extravasation of its contents and peritonitis ensue, or communications take place between it and other portions of bowel, or other organs, giving rise to special symptoms of more or less urgency and danger.

The different kinds of cancer affect the bowels in much the same proportion as they affect the stomach; and present, as they do in the latter organ, certain specific peculiarities which may be briefly adverted to. Scirrhus tends to produce contraction of the parts which it involves, and is especially that form of cancer which causes stricture. The ulcer which it yields is very often smooth and excavated; but sometimes, when scirrhus extends from the outer part of the bowel to the mucous membrane, it assumes in the latter situation the character of soft cancer, and forms there projecting growths, or an ulcer with a tendency to sprout. Encephaloid cancer presents various degrees of softness and vascularity, and rarely causes obstruction of the bowel, except by the formation of a tumor or series of tumors, springing from its mucous aspect and projecting into its cavity. The tumors are rounded, or lobulated, or even villous, and have a great tendency to ulcerate or slough, and bleed. The melanotic variety of encephaloid rarely affects the intestines except secondarily, and in the form of minute discrete black spots, scattered for the most part over the peritoneal surface. Epithelial cancer occasionally involves the rectum by spreading to it from the uterus and vagina; and occasionally, also, arises independently in the lower part of that tube. I am not, however, aware that it ever originates, or is indeed found, in other parts of the intestinal canal. Colloid cancer, or (if it be preferred) colloid disease, affects the bowel usually like scirrhus and encephaloid, from the peritoneal surface, and gradually, like them extending through the intestinal walls, spreads pretty widely in the substance of the mucous membrane, at the surface of which it appears in the form of groups of minute vesicles, reminding one of patches of herpes or of eczema, or (if the fibroid element be in excess) in the form of whitish wheals not unlike those of scirrhus. These become eroded, or more or less excavated, but remain pretty smooth, and secrete in abundance the transparent glairy fluid, with which the interstices of colloid material are filled. Colloid cancer comparatively rarely involves the mucous membrane of the bowel, at any rate to a serious extent. It sometimes appears in the cæcum, sigmoid flexure, or rectum, as a primary disease. Mr. W. Adams[1] records a case in which a colloid tumor, as large as the fist, springing from the posterior part of the rectum, projected into it, and caused symptoms of stricture.

It is difficult, if not impossible, to discuss the symptoms and treatment of intestinal cancer apart from the symptoms and treatment of abdominal cancer generally, or from those of cancer of the stomach and rectum, or from those of its chief local consequences,—namely, obstruction and perforation; it is, moreover, needless, for these are all considered at length in other articles.

(2) *Fibroid infiltration and thickening*, identical with the fibroid form of so-called "scirrhous" pylorus, is met with occasionally in the bowels, where also it constitutes one form of "scirrhus." Its chief, perhaps only, seats are the sigmoid flexure and rectum, where it produces results resembling in almost every particular those which have been described as belonging to true scirrhus. It seems, however, to differ from that in its purely

[1] Path. Soc. Trans. vol. i.

local character, in the absence of all secondary deposits, as well as in its elementary constitution.

(3) *Villous growths* are of occasional occurrence in the large intestine, particularly in the sigmoid flexure and rectum. They generally occupy a limited and well-defined area, which sometimes amounts to three or four square inches or more, and sometimes encircles the gut. The portion of the parietes corresponding to the villous surface is always infiltrated and thickened to a greater or less degree with a kind of fibroid material, which forms the basis from which the villous excrescences spring. The mucous coat and submucous tissue are the parts principally thus affected, and sometimes indeed grow out into a tumor with a constricted neck. The villi are abundant and close-set, easily distinguishable, especially if the tumor be floated in water, often of considerable length, conical, cylindrical or club-shaped, and branching. As we have already seen, villous outgrowths are sometimes distinctly cancerous; but certainly most of those which have been met with in the large intestine seem clearly to have been of a benign character. The presence of a villous tumor sometimes causes hemorrhage from the bowels, or dysenteric diarrhœa: but its ultimate tendency seems always to produce obstruction. In most of the recorded cases death has been the result of stricture. Occasionally, when the growth is situated but a short distance from the anus, it admits of removal by operation.

(4) *Polypi*, or outgrowths of a non-malignant character, are not very infrequently discovered post mortem attached to the intestinal mucous membrane, especially to that of the lower part of the ileum, ascending colon, and rectum, and are sometimes present here in vast numbers. They seem generally to resemble ordinary cutaneous fibro-cellular or molluscous tumors, and consist, like them, of an outgrowth of connective tissue invested in a layer of mucous membrane, which still for the most part presents its normal structure. It seems not improbable that they occasionally originate in connection with the edges of ulcerated patches; but they doubtless more frequently arise independently of any discoverable pre-existing cause. In an early stage they form mere rounded bead-like excrescences, looking like enlarged solitary glands; but they soon elongate, and generally at the same time increase in some degree in other dimensions. When thoroughly developed, they form for the most part cylindrical outgrowths from about a quarter of an inch to an inch in length, and from the thickness of a probe up to that of a director, with extremities which are sometimes bulbous and cauliflower-like, and then highly vascular, and tending to bleed. Sometimes they occur in groups of two or three, or two or three spring from the same pedicle. In the lower part of the ileum, similar bodies, but of a flatter and more leaf-like character, appear occasionally to be produced by mere elongation of portions of valvulæ conniventes. The polypi which have just been described are, as far as I know, of little or no consequence; they occur in persons of all ages and of both sexes, and do not seem to cause any symptoms. Solitary polypi, however, sometimes attain a large size, and may then produce great inconvenience, if not more serious mischief. Pedunculated fibro-cellular polypi from any size up to that of a small pear are now and then met with in the ileum, and are supposed to occasionally cause intussusception; their most common seat, however, is the rectum, in which situation they cause irritation of the bowels, tenesmus, more or less copious bleeding, and other discomforts. These solitary tumors are generally pretty smooth, but are sometimes lobulated or even warty, and mostly abundantly vascular on the surface.

(5) *Other growths* in the intestinal walls are of no practical importance; they are rare, are not productive of symptoms, and do not therefore call for description. Among them may be enumerated circumscribed submucous deposits of fat; small cysts in the same situation; erectile tumors (Rokitansky[1] considers the polypi above described as being erectile); and glandular tumors (in two cases[2] I have met with tumors in the small intestine which resembled the pancreas accurately in structure). Lastly, it may be mentioned that calcareous matter is sometimes deposited in small masses, either on the peritoneal or mucous surface, or in the substance of the intestinal walls.

[1] Path. Anat. Syd. Soc. Trans., vol. ii.

[2] Dr. Montgomery, Path. Soc. Trans., vol. xii. p. 130.

DISEASES OF THE CÆCUM AND APPENDIX VERMIFORMIS.

By John Syer Bristowe, M.D., F.R.C.P.

The cæcum and its appendix are liable, in a greater or less degree, to all those affections which have been described as incidental to the intestinal canal generally. But while some occur here comparatively rarely, or are of trivial consequence when they do occur, others (owing to the connections and position of the organs, partly to their capacity and shape, and partly to their structural peculiarities) involve them with exceptional frequency, or induce results which are characteristic either in their gravity or in some of the other features which they present.

I. General Account of Diseases of Cæcum and Appendix.

Inflammation in its simpler forms affects the cæcum at least as frequently as it affects any other part of the gastro-intestinal mucous membrane. Dysenteric inflammation is only less common here than it is in the rectum and sigmoid flexure. Ulceration of a non-specific kind is perhaps more often met with in the cæcum than in any other named tract of bowel. The ulceration of enteric fever is always more extensive and more advanced in the cæcum than in the colon or rectum, and occurs in it about half as frequently as it occurs in the ileum. Tubercular disease, which affects the large and small intestine with equal frequency, is also generally more severe in the cæcum than in other parts of the large intestine. Cancerous diseases are not very uncommon in this part. And again, the degenerative results of chronic inflammation, and of lardaceous and other forms of deposit, and polypoid growths, occur equally in the cæcum and in the colon and lower part of the ileum. The ileo-cæcal valve and vermiform appendix are for the most part involved whenever the cæcum is the subject of any of the morbid processes which have just been enumerated. The margins of the valve are indeed not infrequently destroyed by ulceration. And the appendix especially rarely fails to present more or less ulceration when typhoid or tubercular deposits occur in other parts of the large intestine.

Strictures of the cæcum form (according to Dr. Brinton) 4 per cent. of fatal strictures of the large intestine. Some degree of contraction at this part is, however, a good deal more common than these figures would seem to indicate. The causes of contraction are, cancerous or other deposit or growth in the walls, and the cicatrization which follows ulceration, especially tubercular and dysenteric ulceration. Dilatation of the cæcum occurs casually, as dilatation occurs in other parts of the intestinal tract, from the temporary accumulation of fecal matters, or flatus, or both. And it occurs also, as in other situations, as a result of obstructive disease in some part of the bowel below it. In this case the dilatation may become very great; and according to circumstances the parietes may be thinned or hypertrophied. It is a point of some importance that not infrequently, even when obstruction is pretty low down, the cæcum is more largely dilated than the length of bowel between it and the seat of obstruction.

Perforation of the cæcum is far from uncommon. Sometimes this ensues on long-continued distension, either from thinning, softening, and sudden laceration, or from the ulceration which so frequently attends distension. Sometimes it is caused by simple perforating ulcer, or by the irritation of some foreign body which has been swallowed, has traversed the small intestine safely, and has become arrested in the cæcal pouch. Sometimes it occurs in the course of dysentery, enteric fever, and tuberculosis. Sometimes it is a result of cancerous ulceration. And sometimes it depends on diseases outside the bowel, such, for example, as cancer occupying the venter ilei, or the extension of a psoas, renal, hepatic, pleural, or other abscess. Perforation may take place directly into the peritoneum, lighting up fatal peritonitis; or it may establish a communication between the cavity of the bowel and the sub-serous cellular tissue of the venter ilei, or some adjoining part, and lead to the formation of a fecal abscess; or again, it may cause a communication with some adherent coil of small intestine.

We can scarcely speak of stricture of

the appendix vermiformis; yet occasionally, as a result of ulcerative destruction of the mucous membrane or of other morbid processes, the whole organ becomes shrivelled up or atrophied. Dilatation, too, sometimes occurs when its orifice is obliterated or obstructed. Then the appendix becomes elongated and plump (perhaps as thick as the little finger), presents often false diverticula (resembling on a small scale those of a sacculated bladder), and is distended with a glairy transparent fluid, the secretion of the mucous membrane. Again, the appendix is apt to become perforated. This accident may be caused in any of the several ways in which the cæcum itself becomes perforated. It occurs sometimes perhaps as a result of mere ordinary ulceration. Dr. Murchison[1] records a case in which it happened in the course of typhoid fever, but where there was no escape of fecal matter. Leudet[2] states that out of thirteen cases of perforation of the appendix, which he observed, six were due to tuberculosis. This statement, however, is certainly not in accordance with general observation. The usual cause indeed of perforation is undoubtedly the presence of some concretion which, by fretting the surface with which it is in contact, excites ulceration, to which the perforation is consecutive. Feces habitually find an entrance into the appendix; but their entrance and escape constitute a normal process on which as a rule no ill consequences supervene. Together with the feces, however, insoluble bodies of small size—seeds, bristles, pins, pieces of bone, shot—are apt to enter the appendix; and some of these, from their pointed or angular form, or from their size, become retained and cause ulceration. Perforation has been caused by bristles, by pins, and by pieces of bone: and indeed it was formerly generally believed that the foreign bodies causing perforation were all of external origin, and for the most part cherry or date-stones, or stones of a similar character. There seems no doubt, however, that bodies of this bulk rarely find their way into the appendix, and that what have been mistaken for them have been concretions resembling them somewhat in size and shape, but differing from them in origin and in constitution. The concretions generally met with vary from perhaps the size of a small pea to that of a date-stone; they are sometimes of waxy consistence and lustre throughout; sometimes brownish, for the most part fecal, and laminated; sometimes again composed almost entirely of earthy phosphates; they consist obviously of the admixture, in unequal proportions of ordinary fecal matters and of the secretions from the mucous membrane of the appendix, and have obviously formed in the situation in which they are found, either round a nucleus of solid matter which has been first precipitated and concreted there, or round some comparatively small body of extraneous origin. Sometimes two or three of these concretions are present at the same time. Perforation of the appendix occurs at any part, sometimes at or near its base, sometimes at its point or within half an inch of it, sometimes again in some intermediate spot. The resulting orifice varies in shape and size. Perforation may take place directly into the peritoneal cavity, causing generally acute and rapidly fatal peritonitis, sometimes a circumscribed peritoneal abscess; or actual perforation may be preceded by adhesion of the appendix to neighboring parts, and the formation of a limited abscess either among the adhesions or in the surrounding structures.

It may be added here, in order to complete our summary of diseases incidental to the cæcum and appendix: that the most common form of intussusception, and the most frequent in children, is that in which the cæcum is engaged; that the cæcum is occasionally the subject of internal strangulation, and that more frequently its appendage takes part in the production of strangulation of other parts of the intestine; and lastly, that the cæcum and its appendage, together or separately, are not very infrequently contained in an ordinary hernial sac.

II. Ulceration and Perforation of the Cæcum and Vermiform Appendix.

(*a*) *Pathology.*—The terms "Typhlitis" and "Perityphlitis,"—the former signifying inflammation of the walls of the cæcum, the latter inflammation in the tissues surrounding the cæcum,—are used frequently, though somewhat vaguely and indiscriminately; but I believe are generally applied to those cases in which there is perforative ulceration either of the cæcum or of its appendix, and in which, therefore, there is either limited suppuration in the neighborhood of these parts, or sudden peritonitis. The perforation in the great majority of cases, no doubt, occurs in the appendix vermiformis: sometimes, however, it occurs in the cæcum itself, beginning there generally from ulceration of the mucous membrane, but occasionally from an abscess situated upon its outer surface. The results which ensue have already been briefly enumerated.

In some instances the ulcer perforates

[1] Path. Trans., vol. xvii. p. 127.

[2] Archiv. Gen., Aug. and Sept. 1859, and New Sydenham's Society's Year Book for 1860.

that portion of the bowel which corresponds to the mesenteric attachment, or, if occurring elsewhere in the bowel, the area in which perforation is about to take place becomes adherent to some viscus in the vicinity, or to some portion of the parietes of the true or false pelvis. The morbid process may stop at that point; or the escape of fecal matter and flatus into and among the tissues may lead to the formation of an abscess, with more or less surrounding inflammation and induration. In the latter event the abscess usually enlarges pretty rapidly, and in enlarging takes a course dependent more or less on its original position, in one case descending into the pelvis, and opening perhaps into the rectum, in another passing out with the pyriformis muscle and presenting in or below the buttock, in another forming a lump in the groin immediately above Poupart's ligament, or passing along the inguinal canal towards the scrotum, or along the psoas and iliacus muscles into the upper part of the thigh. But indeed, when once an abscess has formed, although it may tend as a rule to elect one of several courses, there is scarcely any conceivable direction which under certain circumstances it may not take. No doubt it generally presents itself in the groin as a hardness or lump superficial to the position which the cæcum normally occupies. An abscess of this kind may empty itself and become healed by discharging its contents either through the orifice in the cæcum which gave rise to it, or through an opening at any one of the spots at which, as has been shown, it may present; or having burrowed largely it may form a sinus or series of sinuses which never become obliterated. The communication between the abscess and the cæcum is sometimes maintained, at other times is more or less speedily obliterated.

In other cases the bowel ruptures directly into the peritoneum, exciting at once acute peritoneal inflammation. This may be so severe as almostly directly to prove fatal: but in most cases the patient survives sufficiently long to allow of the more or less complete obliteration by adhesion of the general cavity of the peritoneum, and the formation in the vicinity of the perforated bowel of a circumscribed peritoneal abscess. It is not improbable that in some cases the perityphlic abscesses, the course and progress of which have been already discussed, are really peritoneal abscesses. And it may be added that the abscesses originally unconnected with the peritoneum not infrequently open suddenly into it and evoke, as does the sudden rupture into it of the cæcum or of its appendix, sudden and severe inflammation there.

The statistics of "Typhlitis," using this term as expressive of all the morbid conditions which have just been described, are not very easy to obtain. But as regards the statistics of that section of typhlitis which relates to perforation of the cæcal appendage followed by fatal results, they seem to show very conclusively that this accident occurs chiefly in early life, and much more frequently in males than in females. Thus, in ten cases analyzed by Bamberger,[1] eight were males, two females; eight were below thirty years of age, two above thirty. In thirty-two cases collected by Dr. Crisp,[2] twenty-nine were males, three females; five were under ten years, thirteen between ten and twenty, seven between twenty and forty, and seven between forty and sixty. And in eight cases recorded in the "Pathological Transactions" since the publication therein of Dr. Crisp's paper, five were males, three females; and their ages ranged from thirteen to thirty-four.

The duration of typhlitis must obviously be very various. When the perforation takes place directly into the peritoneum, death for the most part ensues speedily—generally indeed in from three days to a week; life may, however, even in this case be prolonged in consequence of the formation of a circumscribed peritoneal abscess, to two or three weeks or more, and it is not impossible that under the latter condition recovery sometimes takes place. In seven of Bamberger's cases the duration of the illness varied between twenty and fifty days. But when a fecal abscess forms in the tissues in the neighborhood of the cæcum no definite limits can possibly be assigned to the duration of the case; sometimes the patient recovers pretty speedily; sometimes, the case, having got apparently into a chronic state, proves suddenly fatal with symptoms of peritonitis; sometimes again the patient lingers for months, or even years, with a constantly discharging abscess or a succession of abscesses.

(*b*) *Symptoms.*—The symptoms which attend and indicate typhlitis are mainly either those of acute peritonitis, or those of local suppuration, or a complex of both. In those cases in which sudden rupture takes place into the peritoneum, there are very often no premonitory symptoms whatever; occasionally, however, some localized uneasiness or pain, due to the ulceration which is taking place, or to some inflammation of the peritoneal surface corresponding to the seat of ulceration, precedes for a longer or shorter time the violent outbreak. The patient, while in the enjoyment apparently of perfectly

[1] Ueber die Perforation des wurmformigen Anhangs.: Schmidtt's Jahrb. 1859, vol. ci. p. 184.

[2] Path. Trans., vol. x. p. 151.

good health, and at the moment probably of making some muscular effort, is attacked with sudden acute pain in the region of the cæcum, followed speedily by collapse, and the diffusion of pain and tenderness over the whole extent of the abdomen. The symptoms in fact of acute peritonitis are almost instantaneously set up, symptoms which only differ from those of idiopathic peritonitis in the suddenness of their invasion and the severity of the collapse, and differ in no degree from those which attend rupture of the bowel from other causes, rupture of the stomach, or rupture of the bladder. It is needless to dwell on the character of the abdominal pain and tenderness, and on the tympanitic condition of abdomen which ensues, on the dorsal decubitus which the patient is generally compelled to assume, on the quickness and shallowness of his respiratory acts, on his feebleness of pulse, shrunken and anxious expression, and for the most part frequent vomitings and hiccough. But it may be observed, that in spite of, or rather perhaps in consequence of, the unbearableness of his pain, the patient sometimes assumes positions and makes contortions of his body which might seem to be incompatible with the presence of acute peritonitis; that sometimes the peritonitic indications remain pretty strictly limited to the neighborhood in which they commenced, and that very frequently indeed they do not extend above the line formed by the transverse colon; and that sometimes as the case proceeds, proceeds even towards its fatal issue, general peritonitic symptoms almost entirely subside, leaving perhaps a distinct fulness and dulness and tenderness, due to the formation of a circumscribed abscess, in or about the right lumbar or iliac, or the hypogastric region.

In those cases in which an abscess forms in the neighborhood of the cæcum, there are in the first instance pain and tenderness in the region of the cæcum, together with rigors and other general symptoms of inflammatory fever. Generally, too, there is some distinct fulness and tenderness to be felt. The symptoms indeed are for the most part those which might be caused by suppuration, of whatever origin, occupying the venter of the ileum. When the abscess extends downwards into the pelvis, or remains deep-seated, the case is naturally obscure. When, however, it tends to point anteriorly, we find the fulness and hardness become gradually more and more pronounced; the fulness in fact grows into a more or less distinctly hemispherical tumor over which the integuments become œdematous and congested. Sometimes, even at this stage, the swelling gradually subsides and disappears, owing to the abscess having discharged itself into the bowel; but more frequently it still enlarges and ultimately opens externally, discharging a greater or less amount of fetid pus, sometimes having a distinct fecal odor, or even obviously containing fecal matter and bubbles of gas. It must, however, be remembered, that not infrequently the communication with the bowel has been cut off before the abscess opens externally, and that the absence of odor or of gas does not necessarily show that the abscess has not commenced in perforation of the bowel. Sometimes the abscess, after having discharged itself externally, gradually fills up, and complete and permanent recovery takes place. Sometimes, after it has healed externally and appears to have cured, it forms afresh and presents in the same, or some other, situation. In other cases it remains as a permanently open fistula, or as an artificial anus. In these latter cases symptoms of hectic come on, the patient becomes thinner and feebler, and though in some cases life may be prolonged for a considerable period, death generally ensues from gradual exhaustion at the end of a few months, or at the outside a year or two.

There are, however, many cases in which the perforation of the bowel causes abscess in the first instance, and peritonitis subsequently, either in consequence of a fresh intestinal perforation, or of a rupture of the abscess into the peritoneum, or of the mere extension of inflammation by contiguity. These are the cases in which, for the most part, perforation of the cæcal appendix is said to be preceded by premonitory symptoms; and there can be no doubt that it is chiefly by taking these into consideration that cases of perforation of the appendix are estimated by Bamberger and others to have a duration so much longer than we know belongs to mere peritonitis the result of perforation.

It might naturally be supposed that any disease, affecting so important a part of the alimentary canal as the cæcum, would be attended with some disturbance of the functions of that canal. It does not appear, however, that there is any constant disturbance. Sickness is very often entirely absent. Constipation is mentioned as having been present in many cases at or about the time of perforation; but there does not seem to be any definite connection between these two conditions. And diarrhœa not uncommonly supervenes in the course of the disease; but this again would seem to be for the most part a mere accidental phenomenon.

There are many diseases, or incidents of disease, with which typhlitis may be confounded. It may be worth while briefly to call attention to some of the more important of them. Acute peritonitis of idiopathic origin may sometimes

from its suddenness and severity, and from its happening to take the lower part of the abdomen as its starting-point, be thought to have its origin in perforation of the appendix. So also may the peritonitis caused by perforation of the bowel in enteric fever, especially in those cases in which the febrile symptoms are slight and the patient is not compelled to give up work until the sudden rupture takes place. The same also may be said of all those cases in which peritonitis arises from the perforation of a hollow viscus, or of an hydatid or other abscess, from the laceration of the cyst of tubarian or ovarian pregnancy, or from the extension of inflammation from various pelvic organs, especially those of the female. Again, the local suppuration which attends many cases of typhlitis may in some one or other of its stages be easily confounded with abscesses of other kinds, which form in, or find their way into, the region of the cæcum; among which may be enumerated, psoas abscesses, and abscesses extending from the kidney, the spinal canal, and the pleura. It may similarly be confounded with ovarian tumors or inflammation, with cancerous tumors of the ventor ilei or glands in the vicinity of the cæcum, and even under some circumstances with aneurismal tumors.

(c) *Treatment.*—The treatment of typhlitis may be dismissed in a few words, not because it is unimportant, but because it resolves itself into the treatment of enteritis and the treatment of a localized suppuration; the former of which has been discussed elsewhere in this volume; the latter of which is mainly a surgical question. As regards those cases in which there is a direct communication between the bowel and the peritoneum, our main reliance must be placed upon opium; which must be administered, partly with the object of relieving pain, partly with the object of restraining intestinal movements and preventing further escape of fecal matters. For similar reasons, all purgative medicines must be most carefully avoided. In reference to the employment of local measures, such as leeching, fomentation, and the like, no special observations need be made. It is most important of course to administer nourishment and stimulants; and owing to the comparative absence of vomiting, their administration by the mouth can for the most part be much more readily carried out than in cases of enteritis or of obstruction. It is, however, at the same time essential that the bowels should not be overloaded, and therefore that the food which is thus given should be nutritious, capable of easy digestion and absorption, and given in small quantities at frequent intervals. But here indeed, as in many other cases of stomach and bowel disease, it is important to consider how far we may supplement or replace the duties of the stomach and smaller intestine in the absorption of nutriment, by the regular employment of nutritious enemata. When we have to deal with a case of inflammation, circumscribed in the situation of the cæcum, it need scarcely be said that leeching, poulticing, fomentation, and other local remedial measures will naturally be called into requisition; and that, so soon as there are clear indications of the presence of pus, an opening should be made for its evacuation; and that the abscess having been once opened should if possible be kept open, until we have evidence that its deeper parts or ramifications have become healed. In cases of this kind also the use of opium, though not so universally imperative as where there is peritonitis, is generally desirable if not indispensable; and in them also, purgatives, though not perhaps to be absolutely prohibited, should be employed exceptionally only, and with the greatest caution—indeed there can be little doubt that if constipation be sufficiently obstinate to call for medical relief, relief will be afforded best, and by far most safely, by the use of enemata. Lastly, in these cases, as in all cases where there is abundant and long-continued suppuration and hectic, it is of paramount importance that the patient should be sustained by abundance of nutritious food, that he should have habitually a fair proportion of stimulus, and that the use of tonic medicines, especially vegetable bitters, and tonic treatment generally, should be systematically enforced.

[The implication above conveyed, that Typhlitis and Perityphlitis require, for practical treatment, no separate consideration, needs, in my judgment, some qualification. Inflammation of the cæcum (Typhlitis) not uncommonly occurs, with acute and even severe symptoms, yet terminating in resolution, without perforation or peritoneal complication. Moreover, Perityphlitis, *i. e.*, inflammation of the peritoneum localized around the *caput coli*, may, though it does not very often, end favorably without suppuration; and cases have often occurred in which, after suppuration, discharge of pus has taken place spontaneously or with surgical aid, with recovery following.

Having reached the above conclusions upon the basis of my own observation in practice, I find them sustained by Dr. A. Flint,[1] who speaks as follows: "In none of the cases of acute cæcitis which have fallen under the author's observation, has

[1 Clinical Medicine, Philada., 1879, pp. 282 and 310.]

perforation of the intestine taken place, and the termination has in every instance been favorable."

Perityphlitic suppuration is well classified by Dr. Flint by the division of its cases into three groups : (1) Diffused cellulitis ; (2) a collection of pus between the peritoneal surfaces ; (3) circumscribed abscess external to the peritoneum. From the latter two affections, especially, recovery is far from impossible.

In the *treatment* of acute Typhlitis, before or in the absence of perforation, the indications are (as stated in the above article) essentially those of enteritis. Evacuation of the lower bowel by enema should soon be brought about. Castor oil, diffused in flaxseed tea, will here have the advantage of being more emollient than most laxatives so used. If neglected constipation have (as is not infrequently the case) to do with the causation of the disorder, it may even be desirable, at the very beginning, to give a moderate dose of castor oil by the mouth.[1] I have seen very positive benefit from the application of leeches over the site of the local inflammation, followed by poultices of bread, flaxseed, or slippery elm bark, to which, if pain be great, laudanum may be added. At least in the early stage, this mode of obtaining the anodyne effect of opium seems to me preferable to its internal use. Of course, if perforation occur, we have need of the tranquillizing influence of opium, as in other cases of peritonitis. Absolute rest, and a soft, bland diet, are the other important means of favoring resolution in acute Typhlitis. This treatment I have known to be successful in a number of instances. One patient under my care had two attacks, some years apart ; both severe, but recovered from after an illness, each time, lasting about ten days.

Dr. Flint remarks[1] upon the "uniform success" of the operation for the relief of perityphlitic abscess, by opening it as soon as the nature of the case is determined, without even waiting for fluctuation. He refers to the performance of this operation by Hancock, of London, in 1848 ; Willard Parker, 1867 ; and, since that time, by G. Buck, H. B. Sands, J. R. Wood, E. Weber, and others.

Dr. Sands[2] has recorded the history of twenty cases of Perityphlitis, nineteen of which occurred in private practice. Amongst these, resolution took place in seven ; recovery after operation, eight ; recovery after rupture of abscess into bladder, one ; recovery after rupture of abscess into rectum, one ; death after abscess had been opened, one ; death after unsuccessful attempt to reach the abscess, one ; death without operation (from secondary meningitis), one.

The operation preferred by Dr. Sands is that proposed by Dr. W. Parker. An incision two inches in length is made, parallel to Poupart's ligament, over the centre of the tumescent region. After cautiously dividing the abdominal wall to the level of the fascia transversalis, the hypodermic syringe is used for exploration to determine the exact locality of the abscess.[3] Then a deep incision, half an inch in length, completes the operation. The wound should be kept open (by a tent or drainage tube) to discharge for several days. Dr. G. Buck recommended that the operation should not be delayed for more than a week from the commencement of the attack.—H.]

[1] The least disagreeable and least nauseating method of administering castor oil is, to mix the dose with twice its bulk of aromatic syrup of rhubarb.]

COLIC.

By J. Warburton Begbie, M.D., F.R.C.P.E.

The term Colic is derived from the Greek Κῶλον, the colon, or large intestine.

Definition.—The essential character of Colic, as ordinarily understood, is severe pain in the abdomen (in a restricted view, in the colon), augmenting for a time in severity, and then gradually subsiding ; occurring in paroxysms, not stationary, but, on the contrary, moving from place to place, accompanied by a sense of constriction and tearing, for the most part also by that of expulsion.

[1 Clinical Medicine, p. 311.]

[2 N. Y. Medical Record, Jan. 19, 1878.]

[3 Dr. Bull (N. Y. Med. Journal, Sept. 1873) advised the early use of the aspirator in such cases as a measure of treatment.]

The term Colic is now used in nearly the same way as the ancient writers employed that of Κωλικός. It is, however, abundantly evident that the disease described under that name, by Aretæus, for example, was of a much more serious nature than ordinary colic; it was indeed a frequently fatal disorder. In treating of Colics, Περὶ Κωλικῶν, the learned Cappadocian physician, remarks: Κωλικοὶ δὴ κτείνονται ειλῳ και στρόφῳ ὀξέως. By Linnæus, among the early nosologists, Colic is placed in the class "Dolorosi," and is thus defined: "Intestini dolor umbilicalis cum torminibus." Vogel, using a similar expression to denote the class, explains the disease as follows: "Dolores: Colica, dolor spasticus intestinorum cum obstipatione, nausea, et vomitu." Sauvage more simply and briefly styles Colic "Dolor intestinorum;" and Cullen, correctly assigning the disease a position in the class "Neuroses" of his nosological system, of which "Spasmi" is the third order, has thus described it: "Dolor abdominis, præcipue circa umbilicum torquens; vomitus; alvus adstricta." By French and German writers the terms "Colique" and "Die Kolik" are respectively employed when treating of this disease.

A vast variety of painful spasmodic affections have been described under the name of Colic. Of these it may only be necessary to adduce as illustrations the following: "Colica Hepatica," "Colica Nephritica," "Colica Uterina," as applied to spasmodic pain, sudden in its occurrence, and apparently affecting the liver, kidneys, or uterus. These expressions are eminently faulty, and it is desirable that their use should be entirely abandoned.

It is to the consideration of the true or simple Colic, the "Colica spasmodica" of not a few writers, that the present article will be devoted. "Lead Colic," or "Colica Pictonum," and for which many other synonyms have been employed, will be separately considered, while the occurrence of Colic, or of colicky pains, as a symptom of different abdominal affections, inflammatory and otherwise, will be noticed in the descriptions of these maladies themselves.

Symptomatology of Colic.—As has already been stated in the definition of Colic, pain is its essential and most characteristic feature. This pain is seldom continued or uniform for any length of time, but, on the contrary, is marked by the occurrence of remissions or intermissions, and likewise by exacerbations, which are frequently of very great, even intense severity. So extreme is the pain of Colic at times as to cause persons of heroism to utter loud groans and cries. While the whole abdomen or any part of it may be the seat of suffering, the peculiar twisting pain is specially experienced in the situation of the umbilicus, as Cullen observed: "præcipue circa umbilicum torquens."[1] Great restlessness and frequent turning of the body, changing from place to place, distinguish the sufferer from Colic. He does not rest in bed, but is prone to rise and pace up and down the room; bending forwards, he presses his hands over the belly; and when the pain augments in severity is glad to fling himself on his face on the bed or sofa. Usually, while the pain lasts, the trunk is flexed, the upper part bent forward over the lower. If the patient be in bed and lying on the back, the lower limbs with bent knees are often brought in contact with the abdominal parietes, and are thus retained for some time by his hands. A position of this kind is meant when French writers, in reference to the sufferers from Colic, use the expression, "le malade se pelotonne," the patient rolls himself into a ball. By very firm pressure over the abdomen, as by lying on the belly, the pain is sometimes mitigated or even for a time removed, and this circumstance is of some importance in distinguishing a spasmodic from an inflammatory pain, in so far as the latter is invariably aggravated by pressure.

The form of the abdomen is altered during the continuance of Colic. There may be, and this condition is fully the more frequent, distension, with which there is associated the development of flatus on a large scale, or the parietes of the abdomen may, on the other hand, be retracted. The condition of a distended colon, the seat of pain, may be mistaken for that of gastric distension and pain. When the former, however, occurs, as a phenomenon of the attack of Colic, there are present also other indications of intestinal suffering, such as irregular contractions which may frequently be felt by the hand or seen, borborygmi, and specially the sense of bearing down towards, and constriction at, the anus. Besides, as Dr. Wilson Fox[2] has pointed out, pain arising from the large intestines is seldom felt so much at the ensiform cartilage (the common seat of gastric uneasiness) as in

[1] A recent, perhaps the most recent, French writer on Colic (M. Martineau), in describing the pain, remarks: "La douleur est toute spéciale. Les malades en proie à une colique éprouvent une douleur vive, exacerbante, mobile, ayant une grande tendance à s'irradier. Elle se traduit par une sensation de constriction, de resserrement, de tortillement, ou par une sensation de déchirure et même d'expulsion."—*Nouveau Dictionnaire de Médecine et de Chirurgie pratique*, vol. viii.

[2] The Diagnosis and Treatment of the Varieties of Dyspepsia, p. 53.

the right or left hypochondriac regions, while there exists a distinct difference between the notes to be elicited on percussion, from the two organs; that from a distended colon being the less prolonged, and having a higher pitch.

Great general depression is capable of being produced by an attack of Colic. This is seen in the frequently pale countenance of the sufferer, whose pulse also is found to be extremely feeble, while the surface of the body is bedewed with a cold and clammy perspiration. The relation of constipation to Colic is most important. A confined condition of the bowels is usually, though not invariably as some writers have asserted, associated with Colic; and not infrequently, when the bowels have been efficiently acted on by medicine, the pain, which may have been of the severest type, entirely disappears. Neither is this latter, however, the constant result, for, notwithstanding the operation of laxative and cathartic remedies, the pain in some instances proves persistent. Such cases are infinitely less alarming than those in which obstruction of the bowels continues, while the abdominal pain either diminishes or disappears, for in these circumstances the occurrence, sooner or later, of a regular attack of ileus is to be apprehended; while in the former case, the free movement of the bowels, although not immediately, and it may be not even speedily, bringing relief to suffering, is surely succeeded by such before any lengthened period has passed. In some instances of Colic, a confined condition of the bowels, is really the cause of the attack of painful spasm, while in others the constipation is the effect of the spasm. In the more protracted cases of Colic, a general febrile state is liable to be induced. Vomiting may accompany Colic, but is by no means a constant or characteristic symptom of this disorder. Much importance is to be attached to the pulse in Colic, for by its condition we are not infrequently able to distinguish between a simple, although severe spasmodic affection, and an inflammatory disorder. It is to be remembered, moreover, that in some circumstances the latter is not unapt to supervene upon the former. Now, in Colic, while the suffering is even intense, the pulse may be little if at all altered. Assuredly it is by no means uncommon to find the pulse under such circumstances remaining tranquil, and in fact altogether normal. Smallness of the pulse, associated with marked depression of the circulation generally, hardness and irregularity, are, on the other hand, of sufficiently frequent occurrence in cases of Colic.[1] The respiration is hurried, and frequently unequal. The voice is apt to be affected in cases of marked severity; it becomes hoarse, while at times it is so enfeebled as to be almost obliterated. The accession of Colic is by no means uniform or exact. The disease may be established suddenly, even abruptly, and without any apparent cause, or it may come on gradually, succeeding the occurrence, for a time longer or shorter, of abdominal uneasiness, and very probably of occasional cramps, which are clearly traceable to some sufficient cause. Not less variable are the progress and duration of the malady. It may exist for days, or last only for hours, or even minutes. These irregularities are largely determined by the precise causes of the attacks. An irregular intermittence is a characteristic feature of Colic; the duration of the painful seizures, and of the intervals which separate them, being subject to great variety.

[1] In describing the pulse of Colic, Henoch remarks, "Der Puls ist klein und härtlich." (Klinik der Unterleibs-Krankheiten.)

Pathology of Colic.—Although the relation of the abdominal pain and spasm in Colic to nerve irritation is obscure, the following remarks appear to be called for. It has been clearly shown by carefully conducted experiments, and is now admitted, that the pneumogastric nerves possess an influence on the movements of the intestinal canal. Such experiments as those referred to have exhibited the contractions of the muscular coats of the intestines under the application of electrical irritation to the vagi, of as rapid and violent a character as those of voluntary muscles, when their motor nerves have been subjected to a similar irritation. Again, when on irritating the ganglionic plexuses surrounding the aorta, by means of the rotatory apparatus (*durch den rotatorischen Apparat*), the small intestines and colon, which had been previously wholly inactive, when the current began to operate were seized with universally active movements, which continued for a long time after the current was interrupted. It is of further interest to note, that among central portions of the nervous system it is the medulla oblongata which, when irritated by the galvanic current, excites in a decided manner the movements of the stomach and the intestinal canal. Budge saw the same result produced in rabbits, but in a less degree, by irritation of the cerebellum. The spinal cord and cerebrum possess no such influence. All experimenters have described the movements of the intestinal canal as distinctly peristaltic or vermicular.[1] M. Martineau, in his interesting article on Colic, to which reference has been made, has pointed out that while

[1] Romberg, Lehrbuch der Nervenkrankheiten des Menschen; Darmkrampf.

the pneumogastric nerve is more especially distributed, as is well known, to the stomach and liver, a portion of the right nerve passes to the semilunar ganglia to anastomose with the splanchnic nerves of the great sympathetic, and thus to form the solar plexus. Galvanization of the solar plexus and of the superior mesenteric ganglia equally causes contraction of the small intestine and more rarely of the large. Valentin has made the very important observation that an irritation of the fifth nerve, at the base of the skull, invariably gives rise to peristaltic movements of the small intestine, especially of the duodenum and upper part of the jejunum. Such being proved experimentally, we can understand the occurrence of intestinal spasm or Colic, as the direct consequence of some forms of cerebral irritation. And although, as Romberg has remarked, little is known respecting the influence which is exerted by the affections of the spinal cord and brain upon spasms of the bowels, the very potent operation of the emotions, fear and fright especially, but in some instances also joy, in increasing the movements of the intestines is thoroughly appreciated.

Etiology of Colic.—Certain temperaments appear to predispose to the occurrence of Colic. Of these the nervous and lymphatic are the most distinguished. Sedentary occupations act in the same manner. The influence of age and sex is sufficiently marked to be worthy of notice. In youth and adult age, Colic is more common than in advanced life, and among females it occurs more frequently than among males. Among the exciting causes of Colic, one of the most frequent is the presence of some indigestible article of food in the bowels. The influence of cold in producing attacks of Colic is also remarkable, and particularly, it has been noticed, cold applied to the feet. There are some individuals who are certain to suffer from an attack of Colic, if by any means their feet have become cold. The association of biliary derangement with the occurrence of intestinal spasm is not uncommon, and this particular form of the disease has been designated "Bilious Colic." Its distinctive features are the vomiting of biliary matters, and the presence of a more or less icteric tint of the conjunctivæ and surface of the body. Lastly, under this head, it is to be held in remembrance that in some instances the existence of a gouty or rheumatic habit of body plays a decided part in the origination of attacks of Colic, although it may probably be admitted that such constitutional disorders are still more potent in determining the true enteralgia or neuralgia of the bowels, a disease which is to be distinguished from Colic.

Treatment of Colic.—To relieve pain, and generally speaking to act on the confined bowels, are the chief indications for treatment in Colic. In the milder instances of the disease, unaccompanied by any notable derangement of the "primæ viæ," this can usually be accomplished by the external application of warmth, or of rubefacients, such as mustard and turpentine, and by the administration of a little stimulant, or carminative mixture. A small quantity of brandy with hot water, a teaspoonful of the compound tincture of cardamoms in warm water, or twenty drops of the compound tincture of chloroform will be found very serviceable for this purpose. Preparations of peppermint, ginger, and cloves may also be similarly employed. In more severe cases of Colic, or in instances where the remedies already mentioned have failed to relieve the pain, it will be necessary to administer anodyne medicines, and as early as possible to evacuate the bowels. The preparations of opium are most useful among the former; the compound tincture of camphor or English paregoric—in doses of thirty to sixty minims—or a full dose of laudanum. With these a dose of castor oil, or compound rhubarb powder (Gregory's mixture), should be given, and repeated after a short interval if relief to pain and solution of the bowels be not obtained.

A tablespoonful of castor oil with twenty-five drops of laudanum in peppermint water, or two teaspoonfuls of Gregory's mixture with a teaspoonful of compound tincture of camphor, and a similar quantity of aromatic spirit of ammonia in a small wineglassful of cinnamon water, will be found most available prescriptions in such cases.

When the attack of Colic has speedily succeeded the taking of some indigestible article of food, it may be advisable to produce vomiting by the administration of an emetic of ipecacuanha wine, or by draughts of hot water. [*Acidity* from indigestion being present in many attacks of Colic, in such cases, especially with young patients, an early dose may be, of sodium bicarbonate with aromatic spirit of ammonia and spirits of camphor, in an aromatic water. When constipation is present, magnesia may be used instead of soda. If the attack be gouty in origin, oil of cajuput (four to eight drops on lump sugar) may be given with probable advantage. Firm pressure on the anterior superior spinous processes of the ilia sometimes gives great relief. For liability to frequent attacks of Colic, one of the best remedies is sulphur; a teaspoonful twice a week for several doses.—H.]

Should the bowels not respond to the mild remedies already mentioned, it will be necessary to have recourse to the use

of stronger cathartics. Of these, sulphate of magnesia, particularly with the addition of a little sulphuric acid, as Henry's salts, and senna, also the compound jalap powder and calomel, may be regarded as the chief.

The employment of laxative enemata should also be had recourse to. A large injection of warm water will frequently be found most useful in relieving the pain, and in effectually acting on the bowels in cases of Colic.

The prophylactic treatment of Colic consists in a careful regulation of diet, particularly in the avoidance of all indigestible articles of food, and in the protection of the surface of the body from the injurious influence of cold. Wearing flannel over the abdomen, and the warm covering of the feet, are especially to be enjoined.

COLITIS.

By J. Warburton Begbie, M.D., F.R.C.P.E.

There seems to be some ground, at all events, for supposing that the large intestine may be the seat of inflammatory action, differing in essential particulars from the dysenteric process which will be immediately described. To indicate the simple inflammation of the colon, as distinguished from dysentery, the term *Colitis* has been employed. *Colonitis* has been used in the same sense. The French have the word *Colite*, and the Germans the expression *Entzundung des Schleimhautes des Kolons.*

In dysentery the mucous membrane of the rectum and colon is primarily involved while the pathological changes which are so eminently characteristic of the disease are wrought in it. In Colitis, on the other hand, there is in all probability a commencement of inflammation in the sub-mucous or connective tissue, which underlies the mucous membrane, the glandular structures of the latter being in the first instance uninvolved. The result, however, is a diffuse gangrenous inflammation of the mucous membrane; and when this has occurred, there is no possibility of distinguishing the ulceration thus formed from that which has resulted from the dysenteric process.

It is, however, to be borne in mind that the most experienced physicians and ablest writers have differed in respect to the essential pathology and the characteristic morbid appearances in dysentery. The necessary existence of ulceration has, for example, been denied by some, and the special participation of the glandular structures of the colon, so commonly conceived to hold true of dysentery, has been equally opposed by others. In these circumstances it must be admitted that great difficulty at present exists in the way of correctly distinguishing between the different forms—if there really be different forms—of inflammatory disease affecting the colon, and renewed investigation with careful examination of the various structures and tissues entering into the anatomy of that portion of the intestine, is required before any satisfactory conclusions on the subject can be arrived at.

DYSENTERY.

By J. Warburton Begbie, M.D., F.R.C.P.E.

Definition.—A febrile disease, in which inflammation affecting the glandular structures of the large intestine chiefly —although sometimes extending to the small—and producing ulceration, tends to terminate in sloughing of the mucous membrane. The disease is accompanied by much nervous depression, and is characterized by tormina—severe pains in the abdomen of a griping nature—followed by frequent scanty and bloody stools, straining, and tenesmus.

The term Dysentery is derived from two Greek words—δυς, hard or bad, and ἔντερον, a piece of the guts, intestines. Δυσεντερία was itself employed by Hippocrates and other Greek writers to signify a bowel complaint, or bloody flux.

Synonyms.—Tormina; Tormina intestinorum: Fluxus dysentericus; Fluxus cruentus; Fluxus torminosus; Rheuma ventris; Febris dysenterica; Colonitis; Bloody Flux; Dysenteria; Flux de Sang (French); Die Ruhe, Die rothe Ruhe (German); Dissenteria (Italian); Dysenteria (Spanish).

History.—Dysentery has been known as a disease since the earliest period of medical history. In several of the Hippocratic treatises, but especially in the following,—Περὶ ἀέρων, ὑδάτων, καὶ τόπων, Προγνωστικόν, and Ἀφορισμοί,—are many interesting remarks regarding the symptoms and treatment of Dysentery, also the prognosis to be founded upon it, to be met with. Aretæus has described Dysentery with his usual conciseness, and even more than his usual ability. In Cælius Aurelianus, but still more in Celsus, much information may be found regarding Dysentery, as the disease was known in the days of these celebrated Latin writers. Coming down to modern times, Sydenham, Ramazzini, Morton, Huxham, Cleghorn, Morgagni, Zimmerman, and Sir John Pringle (in his celebrated treatise on Diseases of the Army), are among the more distinguished of the numerous writers on Dysentery.[1]

Dysentery is placed by Cullen in class first, "Pyrexiæ," and of it the fifth order, "Profluvia." Of the latter his definition is "Pyrexia cum excretione aucta naturaliter, non sanguinea." Dysentery, Cullen defines as follows: "Pyrexia contagiosa; dejectiones frequentes, mucosæ, vel sanguinolentæ, retentis plerumque fæcibus alvinis; tormina; tenesmus."[1]

It is customary to distinguish between acute and chronic Dysentery, also between epidemic and non-epidemic or sporadic Dysentery. To the non-epidemic disease we are now to direct attention—the epidemic Dysentery having been already considered by Dr. Maclean in Vol. I.

Symptomatology.—The essential characters of Dysentery are severe pains of a griping nature in the belly, followed by frequent and bloody stools, defecation being accompanied by much straining and tenesmus. The latter symptoms are the most characteristic. Watch a patient affected by Dysentery at stool: he sits a long time, straining; his features are distorted by the pain he suffers; the discharge from the bowels may be, often indeed is,

[1] Synopsis Nosologiæ Methodicæ, p. 308.

[Fig. 15.[2]

Submucous connective tissue of the Colon in Dysentery. Magnified 300 diameters. Between the connective-tissue bundles are small, non-nucleated, lymphoid cells, and larger nucleated parenchymatous cells. (From a photomicrograph by Surgeon J. J. Woodward, U. S. Army. Copied from the Second Medical Volume of the Medical and Surgical History of the War of the Rebellion.)]

[1] For a full and instructive account of the history and geographical distribution of Dysentery, see Hirsch, "Handbuch der historisch geographischen Pathologie," article "Ruhe," vol. ii. p. 194.

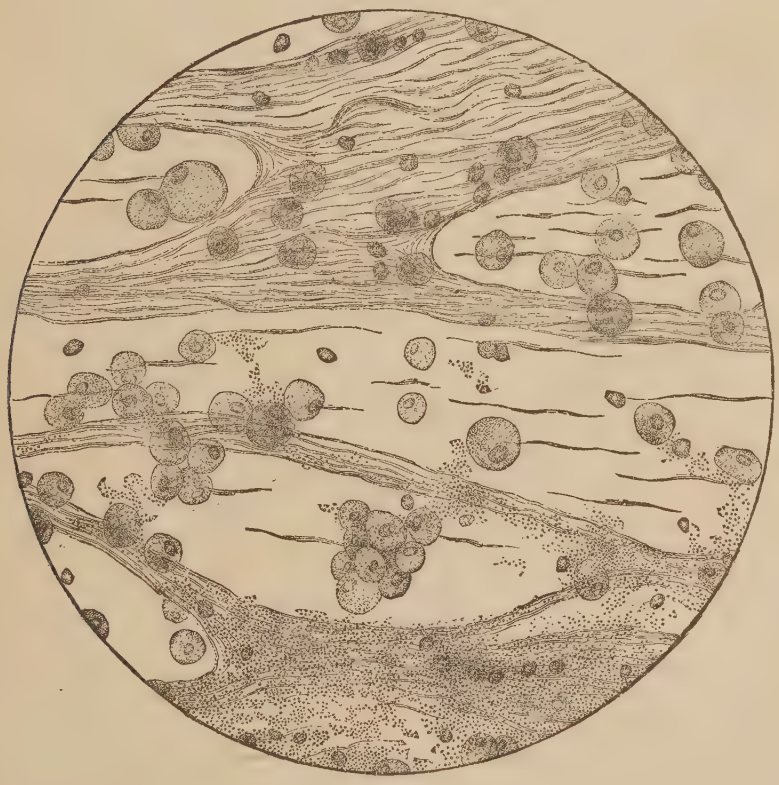
[2] This, and some other illustrations following, would have been equally appropriate to the article on Dysentery in Vol i.; but Dr. Woodward's work, from which they are taken, did not come to hand until after that volume was printed. They are inserted, through the courtesy of its author, not so much as directly related to the text of the present article, as on acconnt of their interest and value, in connection with its subject, to students of pathological histology; the work (Medical History of the War) being accessible to comparatively few of our readers.—H.]

but scanty: still he sits. The strong desire to remain at stool, accompanied by griping and straining, is expressed in the word tenesmus. Scarcely can such patients at times be persuaded to leave the stool and return to bed, until they feel so faint as to be unable longer to maintain the sitting posture, and sometimes while on the stool they faint.

Straining and tenesmus do not occur in diarrhœa, they are peculiar to dysentery; and so also are the other symptoms, named in Cullen's definition; the passage of blood and mucus, the feces being for the most part retained, or after a time passed in the form of small, often hard, scybala.

Acute Dysentery.—The disease in this form may occur without any premonitory symptoms; more commonly, however, it is preceded by such. General uneasiness, lassitude, impaired appetite, disagreeable sensations in the abdomen, confined bowels, or a loose condition of the bowels, are among the more frequent of the premonitory symptoms. These may have existed for a few days, when a chill is experienced, or sometimes a chill or rigor is the very earliest indication of departure from a healthy state. To these succeed

[Fig. 16.



Portion of a perpendicular section through the submucous connective tissue of the Ileum in a case of Dysentery. Magnified 480 diameters. The lymph-spaces are dilated, and contain numerous rounded, granular, nucleated cells, and smaller granular lymphoid elements. In the lower portion are micrococcus groups. (From a photomicrograph by Surgeon J. J. Woodward, U. S. Army. Copied from the Second Medical Volume of the Medical and Surgical History of the War of the Rebellion.)]

the febrile symptoms, heat of skin and quickness of the pulse. Much variety exists in respect to the degree of the general or constitutional disturbance which accompanies the local affection in Dysentery. That may be very slight indeed; the disease may even run its course without fever. On the other hand, the constitutional disturbance may be severe, and is not unfrequently profound, assuming an adynamic or typhoid character. In the simpler variety of the disease, there are at the commencement griping pains in the belly, those pains to which the name of "tormina" is now generally applied. This term was first used by Celsus.[1] "Proxima," he says, "his inter

[1] Liber iv. ch. xv. The description of the disease given by Celsus is so accurate as to merit perusal; the earlier sentences may be quoted. "Intus intestina exulcerantur; ex

intestinorum mala *tormina* esse consueverunt: δυσεντερία Græcè vocatur." The tormina are felt in different parts of the belly, and, like the pain of colic, yield at one time, to return again, perhaps more severely than before. With the tormina there occur discharges, usually slight, from the bowels, and by these a partial relief to the pain is experienced. To the tormina and diarrhœa succeeds the tenesmus; and this term may be understood as including the frequent desire to go to stool, and the reluctance to leave it, with the very distressing feeling of bearing down, and burning sensation in the rectum. In every marked case of Dysentery the tenesmus is a prominent, as it is the most distressing symptom. The discharge from the bowels affords little relief when the tenesmus is great. The calls to stool of course vary greatly in frequency: in some instances they are almost incessant. Occurring in children particularly, but occasionally also in adults, as a consequence of the frequent evacuations, and the tenesmus by which they are accompanied, is prolapsus of the anus, which in itself requires careful management, and may become a very troublesome sequela of the disease.[1]

[*Ileus*, and even fatal intussusception, have been known to occur as rare complications of Dysentery. Lettsom[2] has given the full record of such a case of intussusception. It is less uncommon in connection with diarrhœa, in children. Shaw, Harris, Holmes, Todd, Wachsmuth, and Mann are referred to by Woodward[3] as having reported instances of this complication.—H.]

The discharges from the bowels in Dysentery are peculiar and characteristic. At first they are usually feculent, if not entirely, at least chiefly so; but very soon, becoming very scanty in amount, they are found to be composed of mucus, or of mucus mixed with blood, and sometimes of nearly pure blood. When the inflammation of the bowels has advanced to a certain stage, it is common to notice the appearance of vitiated bile in the stools, and likewise of shreddy-looking portions of fibrine or false membrane. The odor of the evacuations in Dysentery is one *sui generis*, quite peculiar, and highly offensive. Not unfrequently there is sympathetic irritation of the bladder, and a frequent as well as difficult micturition. While the chief part of the pain in Dysentery is experienced during the movement of the bowels, it is not limited to that time—pain is present in the abdomen generally aggravated by pressure. When, in addition to the tenderness over the left side of the belly, corresponding to the position of the sigmoid flexure, there is pain felt over the epigastrium and down the right side, it may be conjectured that the disease has implicated the large intestine in its entire extent, and is not limited, as happens in milder instances, to the rectum and descending portion of the colon.

More or less of fever accompanies Dysentery. In mild cases the feverish disturbance, as already stated, is slight; but, on the other hand, in the more decided instances of the disease, the constitutional disturbance is evidenced by the quickness of the pulse, the augmented temperature of the surface, scanty secretion of urine, and the coated condition of the tongue. In the milder cases of Dysentery there is no special implication of the nervous system; the pulse in such, although frequent, is full and of good strength: neither nausea nor vomiting, except of occasional occurrence, are present; and although the local malady may be severe, the disease wears throughout a sthenic character. But it is not always so; an asthenic or adynamic form of Dysentery also occurs, characterized by a frequent, small, and feeble pulse, pallor and coolness, rather than warmth of the skin, the occurrence of a clammy moisture over it, anxious expression of the countenance, sunken eyes, dryness and glazing of the tongue, suppression of the voice, hiccough, delirium, prominence of the abdomen, and rapid sinking. With these indications there is unusual violence in the local symptoms, particularly as regards the frequency of the discharges from the bowels. These ultimately become exceedingly offensive and watery. They present the appearance of water in which raw flesh has been washed, and are known by the name of "lotura carnium." The disease may thus prove fatal in a few days. Dr. Wood speaks of such cases as very rare, and only seen during epidemics.[1] The

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his cruor manat, isque modo cum stercore aliquo semper liquido, modo cum quibusdam quasi mucosis excernitur; interdum simul quædam carnosa descendunt; frequens dejiciendi cupiditas, dolorque in ano est; cum eodem dolore exiguum aliquid emittitur; atque eo quoque tormentum intenditur; idque post tempus aliquod levatur; exigua requies est; somnus interpellatur; febricula oritur; longoque tempore id malum, cum inveteraverit aut, tollit hominem aut, etiamsi finitur, excruciat."

[1] "Durch die heftigen Anstrengungen wird auch nicht selten, zumal bei Kindern, ein Prolapsus ani herbeigeführt der sich entweder von selbst wieder zurückzieht oder reponirt werden muss."—Henoch, *Klinik der Unterleibs-Krankheiten*, Ruhe, Band 3, p. 235.

[2] Philosophical Transactions, 1786, p. 305.]

[3] Med. History of the War, Part. II., vol. i. p. 391.]

[1] A Treatise on the Practice of Medicine. By George B. Wood, M.D. Vol. i. p. 625.

latter observation is no doubt correct, but only to a certain extent, for these instances of rapidly fatal dysentery, although more common in the epidemic prevalence of the disease, are occasionally met with in the non-epidemic malady. It has occurred to the writer to witness one or two very rapidly fatal cases of Dysentery, in which a remarkable depression of the nervous system was evident from the very commencement of the disease. In the ordinary form Dysentery tends to a

[Fig. 17.

Perpendicular section of a Dysenteric Colon, showing the micrococcus network in the submucosa. Magnified 475 diameters. (From a photomicrograph by Surgeon J. J. Woodward, U. S. Army. Copied from the Second Medical Volume of the Medical and Surgical History of the War of the Rebellion.)]

favorable termination, and usually before the lapse of a week or eight days there are indications of amendment. The acute disease sometimes terminates in chronic dysentery.

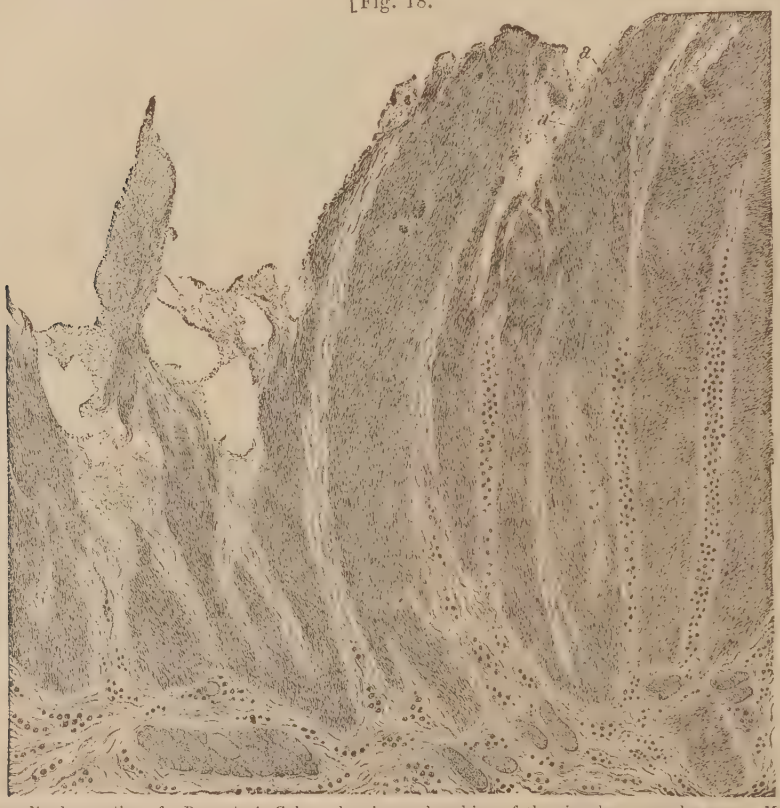
Chronic Dysentery is characterized by the frequency of the evacuations, which, at the same time, are usually very scanty. As in the acute affections, so in the chronic, the discharges are attended by local suffering and tenesmus. Mucus, or mucus mixed with blood, sometimes with purulent matter, constitutes the bulk of the evacuations; feculent stools occur when the disease, instead of implicating the entire colon, is limited to the rectum, or involves with it only the descending portion of the former. Chronic dysentery may last for months or years. In some instances it appears to produce wonderfully little influence on the general health and strength of the invalid, but as a general rule the sufferer from chronic dysentery is emaciated, pale, and weakly; and the disease is not unapt to prove fatal, through the exhaustion consequent upon its long continuance, or owing to the establishment of a state of continual or hectic fever.

Among the morbid conditions which are connected with, or result from, attacks of Dysentery, whether acute or chronic, affections of the liver occupy a chief place, and to these attention will be called in treating of the pathological anatomy of the disease. [*Bilious* dysentery is a term applied by many writers to such cases of the disease as are especially marked by symptoms of hepatic disorder. The term δυσεντερία χολώδης is, indeed, as old as Hippocrates.[1] Galen held that acrid bile, irritating and corroding the intestine, is

[1 Prenotions of Cos, § 24.]

the cause of the symptoms of dysentery. Degner revived this opinion in the eighteenth century, in connection with the history of an epidemic occurring at Nimeguen. Stoll[1] substituted the view which now more generally prevails; namely, that the excess of bile in the discharges, sometimes with vomiting of biliary matter, pain, and tenderness in the side, and not very rarely with abscess of the liver, exhibit proof of hepatic *complication*, but without sufficient reason to accept this as

[Fig. 18.



Perpendicular section of a Dysenteric Colon, showing a sloughing of the circular muscular coat. Magnified 70 diameters. A. Circular muscular layer, hanging in shreds into the cavity of the intestine. B. Scattered fasciculi of muscular fibre-cells belonging to the longitudinal coat, pushed apart by connective tissue infiltrated with lymphoid elements. The dark oval bodies near the upper part are micrococcus nests. (From a photomicrograph by Surgeon J. J. Woodward, U. S. Army. Copied from the Second Medical Volume of the Medical and Surgical History of the War of the Rebellion.)]

the *cause* of the symptoms which affect the lower bowel. Certainly clinical experience shows that cases of Dysentery in which a considerable amount of bile is mingled with the discharges are, generally, more intractable than those in which no such complication occurs.—H.] Anæmia, more or less marked, results from Dysentery. The writer remembers to have seen a case of anæmia of a very typical character, in which the blood impoverishment was due to a long-continued attack of Dysentery. To the occurrence of paralysis in conjunction with Dysentery, Romberg has called attention,[2] and he quotes a passage from an old dissertation by Fabricius: "De paralysi brachii unius et pedis alterius lateris dysentericis familiari,"[1] in verification of the remark. J. P. Frank refers to the same occurrence;[2] and although Graves[3] has not

[1 Ratio Medendi, Part III. § 4, p. 257. Vienna, 1780.]

[2] "Auch bei der Dysenterie," remarks Romberg, "ist das Vorkommenr de Paralyse beobachtet worden."—*Lehrbuch der Nervenkrankheiten des Menschen: Spinale Lähmungen.*

[1] Disputationes ad Morborum Historiam et Curationem facientes quas collegit edidit, et recensuit Alb. Haller. Tomus primus, p. 97.

[2] "Tantum verò ad gradum doloris in abdomine vehementia apud hos vel illos evehitur, ut ab eo non minus ac in colica saturnina brachii aut pedis unius vel alterius paralysis sequatur."—*De Curandis Hominum Morbis.* Auctore Joanne Petro Frank, Liber v. De Profluviis, pars ii. p. 497.

[3] Clinical Lectures, Edition 1864, in one vol. p. 415.

specially mentioned Dysentery as a form of intestinal disease giving rise to a reflex paraplegia, he has emphatically done so in reference in Enteritis. By Zimmer-

[Fig. 19.

Portions of a perpendicular section through a cyst in a Dysenteric Colon. Magnified 200 diameters. The dilated and distorted gland tubules are lined by a columnar epithelium like that of the glands of Lieberkühn. Between the glands tubules is a granular tissue densely infiltrated with lymphoid cells. (From a photo-micrograph by Surgeon J. J. Woodward, U. S. Army. Copied from the Second Medical Volume of the Medical and Surgical History of the War of the Rebellion.)]

man[1] and Joseph Frank[2] allusion is made to paralysis of the arms and legs occurring after Dysentery.

Morbid Anatomy.—As Dysentery is essentially a disease of the large intestines, it is in the colon and rectum that we look for the morbid appearances characteristic of its occurrence.[3] The mucous membrane in these portions either presents the appearance of having been diffusely inflamed, being everywhere much reddened, thickened, and at parts ulcerated, or, with the absence of diffuse inflammation, there exists remarkable prominence of the solitary glands and mucous follicles. There exist three separate and distinct forms of ulceration affecting the mucous surface of the intestines—the tubercular, the typhoid, that met with in enteric fever, and the dysenteric. Apart from other characteristic differences in these affections, the last-mentioned is nearly limited in its occurrence to the large bowel, while the two former are especially met with in the small intestines, and particularly in the ileum. The size of dysenteric ulcers varies. They are sometimes small, and present a nearly circular form, or they are larger, irregular in shape, have an abrupt border, are covered by a dark-colored slough, and appear as if formed by the coalescence of several smaller ulcers. It

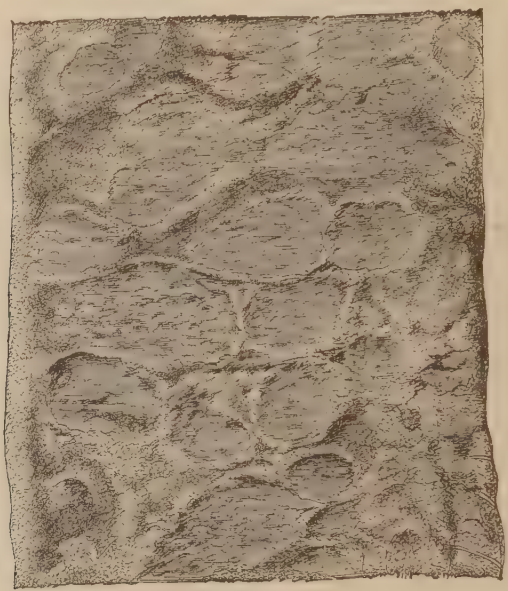
[1] Von der Ruhe unter dem Volke in Jahr. 1765.

[2] Praxios Medicæ Universæ Præcepta. Auctore Josepho Frank. De Paralysi.

[3] The mucous membrane of the colon, says Rokitanski, is the seat of the dysenteric process; and we may state it as a rule, that its intensity increases from the cæcal valve downwards, and consequently is met with in the most fully-developed state in the sigmoid flexure and in the rectum. It not unfrequently passes beyond the cæcal valve towards the ileum, but is here only seen in its mildest form.

is not uncommon to find considerable portions of more or less dense lymph, coating the reddened and thickened mucous surface. Portions of false membrane having precisely the same appearance are sometimes passed at stool; but these, while still adherent to the bowel, do not when removed usually disclose an ulcerated surface. A truly sphacelated condition of the mucous membrane is occa-

[Fig. 20.



Part of descending Colon, with Ulcers. (From a photomicrograph by Surgeon J. J. Woodward, U. S. Army. Copied from the Second Medical Volume of the Medical and Surgical History of the War of the Rebellion.)]

sionally met with, and pieces of gangrenous mucous membrane, sometimes of considerable size, have been passed in the evacuations in certain cases of Dysentery. Perforation of the bowel, which is of no uncommon occurrence in the progress of typhoid ulceration, and occasionally takes place in tubercular disease of the bowels, is very rarely indeed met with in Dysentery: the mucous, submucous, and muscular coats of the colon suffer in this disease, but the peritoneal covering is not so apt to be involved. The mesenteric glands in Dysentery are frequently found tumefied and presenting a dark-bluish color. They may be softened, but are very rarely indeed the seat of suppuration. Even when much enlarged, they have not been distinguished by the presence of any peculiar morbid product such as occurs in the typhoid and tubercular tumefactions of these glands. Rokitansky describes the dysenteric process as divisible into four natural degrees or forms.[1] The anatomical characters of the *first* or lowest form are, swelling, injection, and reddening, softening (red and bleeding), serous exudation in the shape of a delicate vesicular eruption, and consequent branny desquamation of the epithelium (the latter appearance probably led Linnæus to term Dysentery "Scabies intestinorum interna"). In the *second* form, a larger surface of the bowel is involved, but still presenting a deeper development at one part than another—there is copious infiltration of the submucous cellular tissue, giving rise to a greater or less number of prominences, which correspond to those parts of the mucous membrane at which the morbid process is most conspicuous. The intestine is generally in a state of passive dilatation, distended by gas, and occupied by a dirty-brown fluid, composed of intestinal secretions, epithelium, lymph, blood, and feces. The coats of the bowel are thickened, and the submucous tissue especially in a state of tumefaction. In the *third* stage, the prominences are more thickly set, and the result is an uneven lobulated appearance. The mucous membrane investing these prominences is in part converted into a slough, or it may have disappeared, so as to expose the infiltrated submucous cellular tissue to which the remnants of the mucous membrane remain attached, in the shape of solitary dark-red, flaccid, and bleeding

[1] A Manual of Pathological Anatomy. Sydenham's Society Edition, vol. ii. p. 83.

vascular tufts, or as dilated follicles which are capable of easy removal. The contents of the intestine are now of a dirty-brown or reddish, ichorous, fetid, flocculent and grumous character. In the *fourth* and highest degree, the mucous

[Fig. 21.

Portion of descending Colon with sloughing pseudo-membrane. (From a photomicrograph by Surgeon J. J. Woodward, U. S. Army. Copied from the Second Medical Volume of the Medical and Surgical History of the War of the Rebellion.)]

membrane has degenerated into a black, friable, carbonified mass, portions of which may be subsequently voided in the shape of tubular laminæ (so-called mortification of the mucous membrane). The submucous cellular tissue appears to be infiltrated with sero-sanguinolent fluid, or dark blood; or it is pale, and the blood contained in its vessels is converted into a black solid mass. Purulent infiltration of the submucous tissue is also found. The affected portion of the bowel, which contains a putrid fluid resembling coffee grounds, may be either in a state of passive dilatation or (and this is more frequently the case) collapsed. In the higher degrees of the dysenteric process the muscular coat of the colon suffers; its tissue becomes condensed, pale, ashy, and friable. In the same degrees, the peritoneal covering does not completely escape, it presents a dirty-gray discoloration, has lost its lustre, and here and there dilatation and injection of its capillary vessels is visible, while occasionally it is covered by a thin brownish ichorous exudation. These characters afford the means of recognizing the existence of an advanced stage of Dysentery, while as yet the intestine has been unopened, and the mucous surface unexposed. Rokitansky has some very interesting observations on the termination of Dysentery. Provided disorganization of the mucous membrane has not occurred, a cure results through the return of normal cohesion, and the generation of a new layer under the desquamated epithelium. In the more intense degrees of the dysenteric process, and when disorganization has taken place, the mucous membrane having undergone more or less destruction, one of two results ensues—either a real cure of the loss of substance, with consolidation of the abraded portions of the intestine, follows, or the entire process assumes a low chronic form, the specific nature of the disease is lost, and an inflammation atonic in character, with suppuration of the intestinal coat, occurs. Dysentery is fatal through the more or less rapid, or more or less penetrating, destruction of tissue and coincident exhaustion. When cure results, the loss of substance having been inconsiderable, new tissue is formed, and may so contract as to bring the edges of the mucous membrane into apposition with one another, while a cicatrix remains, which has the appearance of a large number of agminated warty excrescences of the mucous membrane between which the sero-fibrous basis from which they proceed may be detected. On the other hand, in those instances of the disease which have been distinguished by an extensive loss of substance, the approach of the edges is impossible, and the deeper layers of the tissue which takes the place of the mucous membrane are frequently condensed into fibrous bands, which form projections into the intestinal cavity, interlaced with one another, and not unfrequently encroach upon the calibre of the intestine, in the form of valvular or annular folds, thus giving rise to a variety of stricture of the colon.

[Several authors,[1] especially in Germany, have divided cases of Dysentery into two groups, viz., *catarrhal* and *diphtheritic* Dysentery. Virchow, Griesinger, Niemeyer, and Heubner have taken this view; which, however, was suggested long ago in the writings of Galen, Cœlius Aurelianus, and Alexander of Tralles. There is reason to believe that cases which begin with the characters of simple catarrhal inflammation may pass, with increase of their intensity, into the

[Fig. 22.

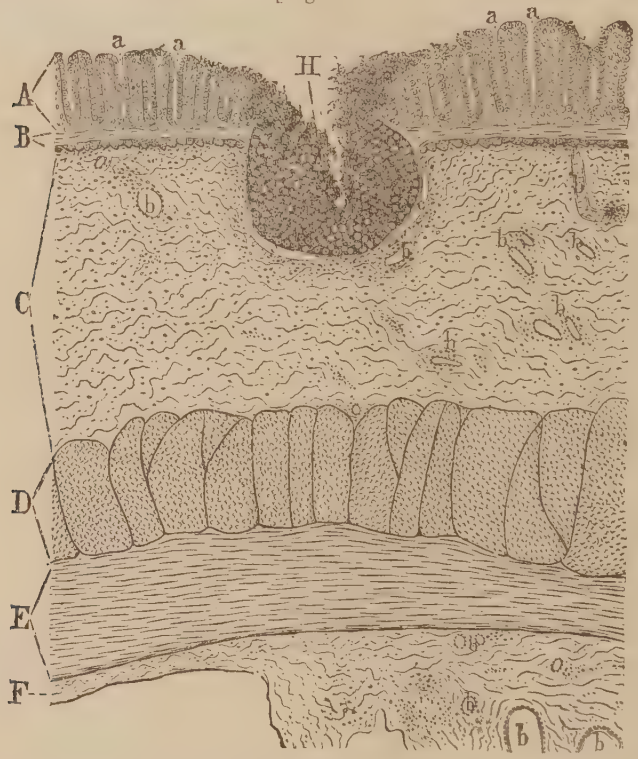


Diagram of perpendicular Section through a follicular ulcer of the Colon, in a case of Dysentery. A. Mucous membrane; *a*, *a*, *a*, *a*, Glands of Lieberkühn pushed apart by lymphoid elements. B. Muscle of Brücke. C. Submucous connective tissue; *b*, *b*, *b*, *b*, Bloodvessels cut across; *c*, *c*. Lymph sinuses beneath the enlarged solitary follicle. D. Circular, E. Longitudinal muscular coat. F. Subperitoneal connective tissue. H. Enlarged and ulcerated solitary gland. (From a photomicrograph by Surgeon J. J. Woodward, U. S. Army. Copied from the Second Medical Volume of the Medical and Surgical History of the War of the Rebellion.)]

pseudo-membranous condition. Other examples of Dysentery occur, in which, even with fatal results, the clinical and anatomical distinctions between the two types of cases are maintained throughout.—H.]

Reference has already been made to the participation by the liver in disease in connection with Dysentery. Abscess of the liver has been supposed by some authorities to have an intimate relationship to the dysenteric process in the colon. Of the not unfrequent association of the two diseases there can at all events be no question. Dr. Parkes[2] found, in twenty-five cases of Dysentery, seven to be affected with hepatic abscess. In the large work of Mr. Annesley,[1] there are twenty-nine cases of abscess of the liver recorded, and of these no fewer than twenty-one, or nearly three-fourths, had ulceration, more or less extensive, in the large intestine, while in two other cases there were appearances of constriction and contraction which were reasonably ascribed to the existence of Dysentery at some former period. Annesley regarded the Dysentery as the result of the disease of the liver, or hepatitis. By certain writers, among whom Dr. Abercrombie[2]

[1] See Woodward, op. citat., p. 338.]

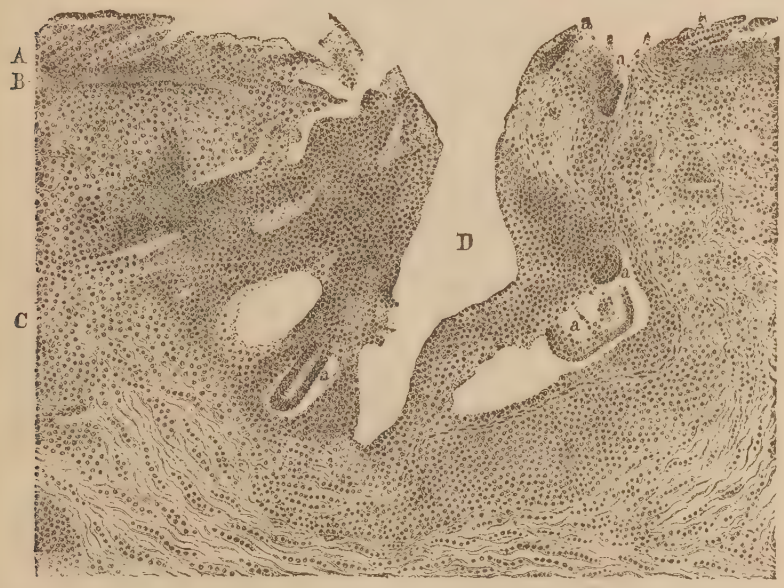
[2] Remarks on the Dysentery and Hepatitis of India, 1846.

[1] Researches into the Causes, Nature, and Treatment of the more prevalent Diseases of India and of Warm Climates generally. By James Annesley, 2 vols. 4to. London, 1828.

[2] Researches on the Pathology of the Intestinal Canal. 1820.

and the late Dr. William Thomson of Glasgow[1] may be mentioned, the concurrence of the two diseases has been regarded as accidental. The former observes: "Dysentery is often accompanied by diseases of neighboring organs, especially the liver, in which are to be found, in some cases abscesses, in others, where protracted in their duration, chronic induration. These are to be regarded as accidental combinations, though they may considerably modify the symptoms."

[Fig. 23.



Perpendicular section through a follicular ulcer of the Colon. Magnified 57 diameters. A. Mucous membrane, partly destroyed by ulceration. B. Muscle of Brücke. C. Submucous connective tissue, infiltrated with lymphoid elements. D. Cavity of follicular ulcer; *a*, *a*, *a*, *a*. Gland tubules and cystic forms derived from the outgrowth of glands of Lieberkühn. (From a photomicrograph by Surgeon J. J. Woodward, U. S. Army. Copied from the Second Medical Volume of the Medical and Surgical History of the War of the Rebellion.)]

A third view, and one which has been popular in this country since it was ably upheld by Dr. Budd,[2] is that the inflammation of the liver terminating in abscess is the result of purulent absorption from the dysenteric process in the colon. Many years ago, Andral and Louis, apparently unsuspecting any connection between hepatic abscess and ulcerated intestines, noticed the coexistence of the former with ulceration in the large intestines and in the lower end of the ileum in two cases, in the lower end of the ileum alone in one case, in the stomach in four cases, in the gall-bladder in one. In one of the cases in which the stomach was affected, Andral concludes with reason that the ulcer was caused by the hepatic abscess bursting into the stomach. But excluding this observation, there resulted seven out of fifteen instances of hepatic abscess, in which there existed at the same time ulceration in some part of the extensive mucous surface which returns its blood to the portal vein. These observations of the French pathologists were very far indeed from being singular. Thus Dr. Cheyne, of Dublin, in writing of the Dysentery in Ireland, remarks that in the majority of his dissections the liver was apparently normal, but that in two cases he found abscesses in its substance. But while the occasional intimate connection of hepatic abscess with Dysentery, and of which Dr. Budd's theory in all probability assigns the true cause, has been determined, it must also be admitted that abscess of the liver frequently occurs in tropical countries wholly unconnected with Dysentery, not acknowledging a pyæmic origin, and not resulting from mechanical injury. Dr. Murchison, of London, in his papers on the Climate and Diseases of Burmah,[1] pointed out that, in many cases, abscess of the liver met with in tropical countries occurred independently of these three causes. Dr. Morehead,[2] while admitting the occa-

[1] Practical Treatise on the Diseases of the Liver and Biliary Passages. 1841.
[2] On Diseases of the Liver, 1845.

[1] Edinburgh Med. and Surg. Journ. 1854.
[2] Clinical Researches on Diseases in India. 2 vols.

sional occurrence of hepatic abscess, according to Dr. Budd's explanations—that is, by the transmission to the liver of pus or vitiated secretion originating in an ulcerated intestinal surface—is satisfied that, as a general proposition, such a view is altogether at variance with the results of clinical research in India. Seventeen cases of hepatic abscess are detailed by Dr. Morehead in which no intestinal ulceration existed. Frerichs, moreover, is of the same opinion, although by no

[Fig. 24.

Portion of perpendicular section through the submucous connective tissue of the Colon in a case of Dysentery. Magnified 175 diameters. The nearly circular vessel to the left and below the centre is a small artery. The longer elliptical form to the right is a vein. Several smaller vessels, cut across, are shown. The connective tissue throughout is infiltrated with lymphoid elements. (From a photomicrograph by Surgeon J. J. Woodward, U. S. Army. Copied from the Second Medical Volume of the Medical and Surgical History of the War of the Rebellion.)]

means denying that, in certain cases, dysenteric as well as other forms of ulceration of the bowels may originate phlebitis of the coats of the portal veins, and so induce hepatic abscess.[1] The abscess of the liver which is found in intimate connection with Dysentery is the multiple abscess, small but numerous collections of pus. This form of purulent deposition Dr. Murchison has very distinctly shown to differ from the ordinary abscess of the liver which occurs in warm climates. In the latter case there is but one abscess, which may attain a very large size, or in a few instances there may be two or three collections. Thus the *pyæmic* or multiple abscess, which is the common form of hepatic suppuration in this country, is to be distinguished from the *tropical* abscess of India and other hot climates; and while the latter may coexist with Dysentery, such connection is wholly accidental. On the other hand, the multiple hepatic abscess, although by no means of frequent occurrence in India, is sometimes met with, but only, as Dr. Murchison has pointed out, in connection with Dysentery or some other source of purulent absorption. The only marked instance of hepatic ab-

[1] "Eine causale Abhängigkeit der Hepatitis von Darmverschwärung ist also keineswegs festgestellt, wenn auch die Möglichkeit nicht geläugnet werden darf, dass ausnahmsweise unter begünstigenden Umständen dysenterische und andere Darmverschwärungen Phlebitis der Pfortaderwurzeln und hierdurch Leberabscesse erzeugen können."—*Klinik der Leberkrankheiten*, Zweiter Band, p. 113.

scess in connection with Dysentery which has fallen under the writer's immediate observation was that of a soldier in a Highland regiment, who, while serving in India, became affected by the latter disease, which ultimately assumed a chronic and inveterate form. He was ordered home, and during his voyage to England the liver became much enlarged. Greatly emaciated and reduced in strength, and still suffering from frequent loose stools, he sank shortly after reaching this coun-

[Fig. 25.

Diagram of perpendicular section of Dysenteric Colon, coated with pseudo-membrane. A. Mucous coat; a, a, glands of Lieberkühn. B. Muscle of Brücke. C. Submucous connective tissue; b, b, bloodvessels cut across. D. Circular, E. Longitudinal muscular coat, F. Subperitoneal connective tissue. G. Peritoneal epithelium. H. Diphtheritic layer, continuous with contents of glands of Lieberkühn. (From a photomicrograph by Surgeon J. J. Woodward, U. S. Army. Copied from the Second Medical Volume of the Medical and Surgical History of the Rebellion.)]

try. Examination of the body after death revealed the existence of a very large number of small abscesses scattered throughout the entire substance of the liver, the tissue of which was in different parts the seat of considerable induration.

ETIOLOGY.—Neither in its acute nor chronic form is Dysentery now a common disease of this country. The decline in the frequency of its occurrence has also been accompanied by a diminution in the severity of its attacks. From producing a very considerable annual mortality, as was the case in the seventeenth century, Dysentery now occupies a very low place among the causes of death. Essentially a disease of hot climates, its prevalence is, in these, observed to depend to a considerable extent on meteorological changes, while in temperate climates Dysentery is emphatically an autumnal malady. The continued exposure of the body to an elevated temperature predisposes to the occurrence of Dysentery; this it does, in all probability, by an injurious operation on the mucous membrane of the whole alimentary canal leading to its increased excitability, and by disordering the function of the liver: thus exposed, the sudden reduction of temperature, which so frequently takes place in the night season of our autumns, acts as a direct exciting cause of the disease. Thus, while heat predisposes to Dysentery, cold excites it. [The frequent association of Dysentery with malarial fevers has been observed in almost all quarters of the globe. Whether this is merely a coincidence, due to the common relation of both to high temperature, or is an indication that the "materies morbi" of malarial fevers and that of endemic dysentery is the same, has been, so far, inconclusively debated. The predominance in the evidence is against this identity. In favor of it, Dr. Woodward[1] cites Chisholm in regard to the West Indies; Annesley, Grant, Hare, and Cameron for the East Indies; Haspel for Algeria; and Sigand for Brazil. But, on the other hand, there is ample proof of the occurrence of Dysentery and malarial

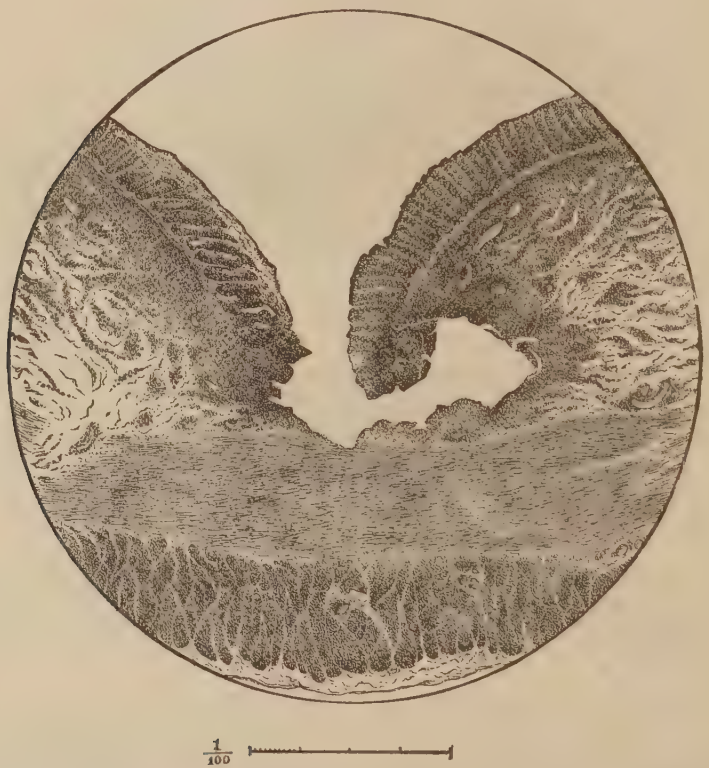
[1 Op. citat, p. 400.]

fevers, independently of each other, in a number of places. Dutrolau[1] and Hirsch,[2] amongst others, have sufficiently established this.

It was remarked, by the late Professor N. Chapman, that, in this country, not unfrequently Dysentery prevails in rather hilly localities, adjoining, or not far removed from, low grounds subject to malarial fevers.

The coexistence of remittent or intermittent fever with Dysentery is, at all events, not uncommon. Periodicity may, in this as in other affections, be impressed upon the intestinal disorder; with the resulting indication, in practice, for the

[Fig. 26.



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Perpendicular section through a follicular ulcer of the Colon, in a case of Chronic Dysentery. (From a photomicrograph by Surgeon J. J. Woodward, U. S. Army. Copied from the second medical volume of the Medical and Surgical History of the War of the Rebellion.)]

treatment of the periodical or malarial element first or chiefly, while not neglecting the dysenteric symptoms. It is a plausible suggestion of Colin[3] and others, that drinking the water of certain regions promotes Dysentery, while the aërial emanations of the same places generate malarial fevers. Several American physicians of large experience have reported observation of the coincidence of the two diseases, both in civil and in military practice. Of these, Dr. Woodward[1] gives the names of the following: Bowling, Long, H. W. Davis, R. Campbell, J. P. Evans,

[1 Traité des Maladies des Européens dans les pays chauds, 1868, p. 112.]

[2 Harbuch der historisch-geographischen Pathologie, Bd. ii., Erlangen, 1862–4, § 238.]

[3 Annales d'Hygiene, T. 38, 1872, p. 241.]

[1 Op. citat., p. 402. The following references are given by Dr. Woodward: W. K. Bowling, Western Journal of Med. and Surgery, 1840, p. 166; J. J. Long, Nashville Journ. of Med. and Surgery, 1856, p. 31; H. W. Davis, North-Western Med. and Surg. Journal, 1856, p. 295; R. Campbell, Southern Med. and Surg. Journal, 1857, p. 707; J. P. Evans, Charleston Med. Journal and Review, 1858, p. 433 et seq.; G. Dowell, Galveston Med. Journal, 1866, p. 43; S. M. Bemiss, N. Orleans Med. and Surg. Journal, 1867, p. 42; N. S. Davis, Chicago Med. Examiner, 1871, p. 461; W. A. Jones, Western Retrospect, 1872, p. 125.—H.]

G. Dowell, W. A. Jones, Bemiss, and N. S. Davis.

Geological peculiarities of localities have often been supposed to promote Dysentery. Those who have made an extensive survey of the facts, as Hirsch[1] and others, conclude that no constant relation of this kind exists. Limestone, volcanic, alluvial and other formations are all, under similar climatic conditions, subject to Dysentery.

In U. S. Army experience, as shown in the official work from which so much is drawn in the present remarks, the proportion of cases of Dysentery has been more than twice as great in the middle and southern than in the northern divisions of the United States; and the proportion of deaths more than three times as great. This has been true in times both of peace and of war. According to the United States census of 1870, however, a different state of things exists in civil life. No general correspondence is therein shown between the prevalence of malarial fevers and that of Dysentery, diarrhœa, and enteritis; while, of the latter group of diseases, the greatest mortality is shown to belong to the northern districts, particularly in the central region. This stands strongly against the malarial theory of the causation of Dysentery; although this disease has not been, in the statistics of the census referred to, separated clearly from other bowel affections, whose geographical etiology may be different.

No doubt exists that, in America as well as elsewhere, epidemic periods of the prevalence of Dysentery occur in many localities.

Noah Webster, in his History of Epidemics, mentions three such periods in the United States during the eighteenth century; namely, from 1749 to 1753; from 1773 to 1777; and from 1793 to 1798. In all of these the New England States were chiefly affected. Dr. Woodward refers to numerous local epidemics occurring in the United States during the present century; only one of these having extended much over the country; viz., from 1847 to 1856.

Season has a very marked influence upon the prevalence of Dysentery.

In the United States, both in the army and in civil life, and in the negro as well as in the white population of all the States, the greatest number of cases occurs in the autumn. According to the census of 1870, the minimum of mortality is in January and February; the maximum in August. Hirsch's[2] account of the mortality from Dysentery in Europe agrees essentially with these facts. In tropical regions the maximum mortality occurs somewhat later; in the northern hemisphere, from September to November; in the southern in March and April. Conditions related especially to the greatest heat of the year, and the transition from this to the colder season, appear to be always and everywhere promotive of Dysentery.—H.] Unwholesome food has a potent action in the production of Dysentery. In this way unripe fruits, or even the ripe fruits when inordinately consumed, also vegetables, acid wines, and impure water, have particularly been supposed to act. There can indeed be no doubt that most of the slight, and some even of the severer cases of Dysentery which we meet with, are occasioned by a distinct error in diet, or are traceable to the introduction into the alimentary canal of some substance or fluid of a deleterious or directly irritating nature. The not unfrequent connection of Dysentery with ague, and their observed alternation, have led to the impression that the former disease, like the latter, acknowledges an origin in malaria. That Dysentery may be produced by exhalations from putrid animal and decaying vegetable substances may perhaps be admitted; but the probability is that the relation of this disease to intermittent and remittent fevers, formerly insisted on, was not, strictly speaking, etiological, but to be accounted for by the disordered state of the portal circulation, which, occurring in ague, led indirectly to the inflammatory affection of the colon. The contagious nature of Dysentery has been asserted by some authorities; facts are, however, entirely wanting to prove the communication of the disease from person to person, in the sporadic form of the disease, with the consideration of which we are occupied; and in regard to the epidemic Dysentery, it may be admitted that the experience which appears at first sight to justify this conclusion, admits of another and more satisfactory explanation.

[Dr. Woodward[1] reviews the evidence given in different quarters in favor of the opinion that Dysentery is propagated by contagion; with the conclusion that this has not been demonstrated. Most of the instances adduced are better accounted for by the indubitable promotive effect of the contamination of drinking water by decomposing organic matter; without needing to suppose the presence of a specific *contagium*. Dr. Woodward remarks, concerning the experience of the civil war, that "Belief in the contagion of Dysentery was by no means common amongst our medical officers." "Nowhere have I heard of any local outbreak of Dysentery among the civil population which was distinctly traceable to the

[1 Op. citat., Bd. ii. § 238.]
[2 Op. citat.]

[1 Op. citat., pp. 512, 650.]

arrival of any of the tens of thousands of dysenteric subjects who went home to recover or die."—H.]

Treatment.—Dysentery in its acute form demands an energetic treatment; it is not a disease which can with safety be entrusted to the "vis naturæ medicatrix." Confinement to bed is of primary importance, the very rest favoring the arrestment of the malady, as much as movement of the body promotes its progress. Blood-letting was formerly practised in the treatment of Dysentery, and when pain is severe, and continues unrelieved by warm applications and rubefacients, local blood-letting by means of leeches applied over the track of the colon

[Fig. 27.

Perpendicular section through a small superficial ulcer, H H, in which an intact solitary follicle, I, protrudes. Half-diagrammatic drawing. Magnified 48 diameters. A. Mucous membrane. B. Muscle of Bürcke. C. Submucous connective tissue; *b*, *b*, *b*, small veins cut across. D. Circular, E. Longitudinal muscular coats, divided by the entrance of an artery, *a*, accompanied by a vein and surrounded by connective tissue. (From a photomicrograph by Surgeon J. J. Woodward, U. S. Army. Copied from the second medical volume of the Medical and Surgical History of the War of the Rebellion.)]

may still be had recourse to. The application of a few leeches to the verge of the anus has been recommended by some authors, and in the experience of the writer has appeared to be beneficial.

An indication of great importance in the treatment of Dysentery is to free the bowels from all irritating accumulations. This is best done by the employment of the gentler laxative medicines. Strong cathartics are not to be used. Castor-oil has been almost universally regarded as the best remedy for this purpose. Where much pain exists the oil may from the first be combined with a little laudanum; in the more advanced stages of the disease it will be prudent to associate the latter with it at every dose. The alternation of laxatives and opiates in the treatment of Dysentery has been highly praised by many practitioners. "It is the practice of some physicians," writes Sir Thomas Watson, "to prescribe laxatives and opium together; but in this complaint it is better to alternate them."[1] [Castor-oil is now seldom given in American practice except in a single dose during the first or second day of the attack. At that time it may serve the purpose of removing feces which might remain and irritate the bowel, notwithstanding the frequency of the morbid but small discharges. It is generally made more gentle in its effect by the addition of ten or fifteen drops of laudanum.

The employment of *saline* cathartics, in moderate doses, continued for several days, has had an important place in practice in some quarters. This medication originated in the seventeenth century, when Glauber's and Epsom salts acquired

[1] Lectures on the Principles and Practice of Physic, vol. ii.

considerable reputation in the treatment of Dysentery. Later, Heberden advised drachm doses of sulphate of magnesium every six hours; Cleghorn and Zimmerman have used, instead, cream of tartar; and Seignette, the inventor of Rochelle salt,[1] urged its employment in both Dysentery and diarrhœa. Savignac is quoted by Woodward as favoring Rochelle salt and phosphate of sodium; Woodward's own preference, however, being for the sulphate of sodium. The last named salt has been shown by Rutherford and Vignal to produce (in dogs) an increase in the secretion of bile; and somewhat of the same effect is shared also by phosphate of sodium and Rochelle salt. It does not follow from this that it will always be beneficial in Dysentery; as, in some of the severest cases, and hardest to relieve, there is a considerable amount of almost unchanged bile in the stools. Although some of this may be accounted for by the abnormal *non-absorption* of bile from the intestine, on account of the morbid condition of the latter, yet concurring hepatic symptoms often make it almost certain that the biliary secretion is in excess in the cases of so-called "bilious" Dysentery. Not a few practitioners, however, in America, as well as in Europe, have found excellent results to attend the use, in small *laxative* doses only, of the sulphates of magnesium and sodium, in the early stages, *i. e.*, the first week, of acute Dysentery. My impression is that they do the most good in cases attended by considerable fever.—H.] Opium by not a few has been regarded as the "summum remedium" in this disease. It was the favorite remedy of Sydenham in meeting the formidable Dysentery of his generation, and it is in allusion to its efficacy that the "prince of English practical physicians" rapturously exclaims—"And here I cannot but break out in praise of the great God, the giver of all things, who hath granted to the human race, as a comfort in their afflictions, no medicine of the value of opium, either in regard to the number of diseases that it can control, or its efficacy in extirpating them. . . So necessary an instrument is opium in the hands of a skilful man, that medicine would be a cripple without it; and whoever understands it well, will do more with it alone than he could well hope to do from any single medicine. To know it only as a means of procuring sleep, or of allaying pain, or of checking diarrhœa, is to know it only by halves. Like a Delphic sword it can be used for many purposes besides. Of cordials it is the best that has hitherto been discovered in nature. I had almost said it was the only one."[2] Opium may be administered either in full or in small doses, and each of these methods has its supporters. It may be given alone, or combined with ipecacuanha in the form of Dover's powder. Ipecacuanha itself is again largely employed, and more especially of late years in India. We say *again* largely employed, for it is worthy of remark that the ipecacuanha, originally known as a medicine about the middle of the seventeenth century, was first used as a remedy in Dysentery. Brought to Europe from Brazil by Piso, and some time afterwards made the subject of experiment in Paris by Adrien Helvetius, it was long known as the "radix anti-dysenterica,"[1] the "pulvis anti-dysentericus." Subsequently to its original employment in France, in doses from one to three drachms, it was used in this country and its colonies by Sir John Prindle and other physicians, in doses varying in amount, that ordinarily given being a scruple. More recently the names of Mr. Mortimer, Mr. Twining, Mr. Docker, and several other Indian surgeons, have been identified with the practice of exhibiting ipecacuanha in Dysentery. The therapeutic action of the remedy has been variously ascribed to its nauseant, its diaphoretic, and its laxative or purgative effects. The latter was the view entertained by the distinguished writer Sir John Pringle. Dr. Maclean thus expresses himself in regard to it: "It is probable that ipecacuanha owes much of its usefulness in this disease to its action as an evacuant. It is a blood depurant of an effective kind. It appears to increase the secretion of the whole alimentary canal, as well as of the liver and pancreas: under its use tormina and tenesmus disappear, and feculent evacuations are more quickly restored than by any other known remedy."[2] Dr. Morehead has always used ipecacuanha in Dysentery from a consideration of its efficacy being due to its laxative action. This physician counsels the exhibition of the ipecacuanha according to the plan of the late Mr. Twining,[3] viz., "from six to three grains, combined with blue pill from five to two grains, and extract of gentian from four to two grains, every third, fourth, sixth, or eighth hour, and to continue it steadily till amendment takes place. The proportion of the dose and the frequency of its repetition must depend on the acuteness of the symptoms.

[1] Woodward, op. citat., p. 707.]

[2] Medical Observations: Dysentery.

[1] For an interesting account of the early history of ipecacuanha, see "Traité Thérapeutique et de Matière Médicale," par A. Trousseau et P. Pidoux, vol. i. p. 666.

[2] Reynolds's System of Medicine, article Dysentery.

[3] Researches on Diseases in India, vol. i. p. 560.

The duration of the treatment, and the gradual diminution of the dose and of the frequency of its exhibition, must be contingent on the rapidity and permanency of the amendment. It must also be kept distinctly in view that, whilst the treatment by ipecacuanha is being pursued, it is often necessary—according as the state of the pulse or the uneasiness of the abdomen on pressure may indicate the necessity—to apply leeches; and also—according to the character and scantiness of the evacuations, and the greater or less fulness of the abdomen—to give castor-oil occasionally in moderate doses." The reliance on the therapeutic action of ipecacuanha is most conspicuously exhibited, however, in the plan of its use suggested by Mr. Docker, and adopted by Dr. Maclean,[1] and now generally followed in India:—

"The patient should be at once ordered to bed, and as quickly as possible brought under the influence of ipecacuanha in large doses. Some insist on the propriety of first giving a full dose of Battley's sedative, tincture of opium, or a few drops of chloroform, with the intention of making the stomach tolerant of the remedy, and restraining nausea and vomiting. I believe that the sedative in some cases is useful, and acts in the manner just described. On the other hand, I have often seen ipecacuanha do its work well, and with little disturbance of the stomach, without opium. Should it be determined to premise opium, thirty drops of the tincture should be given, and in half an hour followed by from twenty-five to thirty grains of ipecacuanha, which should be given in as small a quantity of fluid as possible; a little syrup of orange-peel covers the taste as well as anything else. As already advised, the patient should be kept perfectly still, and abstain from fluid for at least three hours. If thirsty, he may suck a little ice, or a teaspoonful of cold water at a time may be allowed. It is seldom that under this management nausea is excessive, and vomiting is rarely troublesome, seldom setting in for at least two hours after the medicine has been taken. The abdomen should be covered with a large sinapism, or a sheet of spongio-piline sprinkled with a little turpentine after being wrung out of hot water. In from eight to ten hours, according to the urgency of the symptoms and the effect produced by the first dose, ipecacuanha in a reduced dose should be repeated, with the same precautions as before. All who have had opportunities of trying this mode of treating Dysentery can bear testimony to the surprising effects that often follow the administration of one or two doses of ipecacuanha given in this manner. The tormina and tenesmus subside, the motions quickly become feculent, blood and slime disappear, and often, after profuse action of the skin, the patient falls into a tranquil sleep and awakens refreshed. The treatment may require to be continued for some days, the medicine being given in diminished doses, care being taken to allow a sufficient interval to admit of the patient taking some mild nourishment suited to the stage of the disease." If the writer be entitled to express an opinion regarding the use of a remedy which he has had but few opportunities of employing in the treatment of Dysentery, but has had very frequently prescribed in cases of depraved action of the chylopoietic viscera, he feels inclined to ascribe the eminent therapeutic virtues of ipecacuanha to its direct action on the secerning function of the liver. [Non-nauseating doses of ipecacuanha are extensively used and approved in America in the treatment of Dysentery. During the early stage, my own preference is for its administration in quantities not larger than one grain every two or three hours; at first with camphor, and afterwards, if the case does not at once yield, with opium.—H.]

The employment of mercury in Dysentery is as warmly defended by some practitioners as it is condemned by others. In all stages and forms of the disease Dr. Maclean depreciates its use, while Dr. Wood asserts that no remedial influence is more effectual in Dysentery than that of mercury. Anything like the production of profuse salivation is certainly to be avoided; and although favorably influencing the progress of Dysentery in some cases, chiefly through its action on the liver, it will generally be admitted that in ipecacuanha, and in the employment of mild laxatives alternately with opiates, we possess more efficacious and certainly safer remedies.

It is in the more chronic form of Dysentery that such powerful astringents as acetate of lead, sulphate of copper, sulphate of zinc, the Indian Bael fruit, hæmatoxylon, and the sulphuric acid, are chiefly useful. [An excellent preparation, in obstinate cases, is a combination of acetate of lead with acetate of morphia. Pernitrate of iron is confided in by many practitioners. It is not so powerful an astringent as acetate of lead; but its agency as a chalybeate may make it especially suitable in some anæmic chronic cases. I have seen excellent effects from the use of creasote with morphia, in chronic Dysentery.—H.]

Among alterative remedies copaiba and turpentine, creasote and nux vomica, have been commended. Quinine will favorably influence the progress of malarial Dysentery, when employed as an ad-

[1] Reynolds's System of Medicine, vol. i.

junct to other remedies; and iron, in the form of the pernitrate more especially, is called for when fluidity of blood as evidenced by hemorrhages and cutaneous petechiæ exist; just as in scorbutic Dysentery, when chronic, milk and fresh fruits are indispensable articles of treatment.

Enemata of warm water cautiously introduced into the rectum are frequently grateful to the patient, and are useful in the early stages of Dysentery in bringing away hardened scybalous masses, the continuance of which in the bowels is attended by much irritation and suffering. Opiate, enemata, and those containing ipecacuanha, and various astringents, may sometimes be employed with good effects. [Alum, in enema (four teaspoonfuls to a pint of water), has been reported by Mosler[1] to have acted extremely well in a protracted case. I have known an enema of a solution of sulphate of zinc (five to ten grains in four fluidounces of flaxseed infusion) to produce a favorable change in a short time. For the relief of suffering, injections of laudanum are often very important.—H.] In Dysentery assuming a typhoid or adynamic type, it is necessary to support the patient's strength by the exhibition of stimulants; but these are, as a general rule, not well borne in this disease, and should always be administered with the greatest degree of caution.

The diet in Dysentery is of much importance. When the disease is comparatively slight and unattended by serious febrile symptoms, most farinaceous food may be allowed. When, however, the severer form of the disease is in existence, bland drinks are alone admissible: milk with lime-water, or Carrara water, may be regarded as the chief article of diet, and generally speaking is the one most relished by the patient.

Great attention should be paid to preserving the cleanliness of the patient, the dress, and bed-clothes, and in keeping the atmosphere of the sick-room as pure as possible, impregnated as it must from time to time become with the offensive odor of the discharges. The use of Condy's fluid, of weak chlorine vapor, or of carbolic acid for this purpose, is invaluable [and abundant ventilation is still more effectual.—H.].

Sponging the surface of the body with tepid or warm water is desirable, and is usually found most grateful by the patient.

It may be added in connection with the treatment of chronic Dysentery, that change of air is frequently more efficacious than the use of drugs. Removal to the sea-coast, or a voyage, is specially to be recommended.

A flannel belt round the abdomen is an article of clothing which the convalescent from Dysentery, as well as all those who are prone to suffer from this disease, should adopt and constantly wear.

DIARRHŒA.

By Edward Goodeve, M.B.

Definition.—Frequent loose alvine evacuations, without tenesmus; due to functional or organic derangement of the small intestines, produced by causes acting locally or constitutionally.

In Diarrhœa the evacuations are liquid or semi-liquid, and vary in quantity, quality, and frequency, with the peculiarities of the disease. They differ in chemical composition, being more or less watery, serous, or mucous, and more or less mixed with the natural contents of the intestines, secretions and other matters poured into the upper part of the alimentary canal. In the acute forms some are dangerous to life, and the same may be said of all the chronic or prolonged forms. The most dangerous of the acute Diarrhœas are those in which there is profuse liquid purging, approaching, in fact, to that of Asiatic cholera.

Nature and Effects.—Diarrhœa cannot be considered as a simple disease. It is rather a symptom of many derangements of health, and is determined by many widely different causes. The matters evacuated come from the small intestines; but though the mucous surface of these is the seat of the flux, the producing causes are often remote from it. Hence these may be separated naturally into two divisions, viz., into such as act locally as irritants, and such as act constitutionally. Both the local and the distant causes may produce either what is called functional disorder, or serious organic disease of the mucous membrane, such as congestion,

[1] Allg. Med. Centr. Zeit., No. 102, 1878.]

inflammation, ulceration, thickening and degenerations of tissue. In the official returns, Diarrhœa is classed in the miasmatic order of the zymotic diseases. This may be a proper place for some of the forms; but many do not depend upon any zymotic origin, and ought not, without reservation, to be included in that class.

Diarrhœas are produced differently, according to the nature of the cause. All those which act locally, cause flux by direct irritation of the mucous surface. In all these which depend upon constitutional causes, the fluxes are the means by which the blood is purified of morbid matters; hence they may prove beneficial, as in the instances of critical discharges from the bowels in some fevers and sometimes in gout, &c.; and also, sometimes, by the habitual freeing of the blood from noxious matters, as in albuminuria. In some cases the eliminative process is attended with organic mischief, as in enteric fever, in which deposits and ulcers occur. In some instances probably, not being eliminative, fluxes may be due to reflex disturbances of the functions of the mucous membrane, excited by impressions acting through the nervous system.

It must be remembered that the evacuation depends upon two elements, secretion and muscular contraction, and that these are not always in proportion one to another. The number of stools may vary considerably in twenty-four hours, from three or four to fifteen or twenty; and the frequency may depend upon the quantity of matter secreted, the quality of the secretion, and also upon the degree of irritability of the muscular fibre. In some instances a small quantity of secretion is less easily borne than a larger one in another case, and then the motions will be frequent, though small. In many cases the irritability of the fibre is so great that the contents of the bowels, whatever they may be, are rapidly hurried through the tube, before the lacteals have time to act upon them, so that the degree of irritability of the muscular element is a very important feature in the disease. In some instances the evacuation is caused by reflex muscular action upon taking food or drink into the stomach. In these cases people will say, that immediately after swallowing, their bowels are moved. Young children also frequently have a motion at the time of nursing. Patients think, in these cases, that what they take passes through them immediately. This is obviously not the case.

It has been stated that the evacuations vary in composition. The chief constituents of the stools are mucus, albumen, fibrine, water, and saline matters, mixed with food and natural and morbid secretions. Blood is rare. The chemical nature of the evacuations will not serve as a means of classification of these fluxes. It is very seldom that the same kind of discharge continues throughout the disease. The different products are often mixed together in the same stool, or they vary in quantity from time to time in the same case. It may be conceded that the more fibrinous or mucous the discharges, the more reason there is to suppose that the flux is due to congestive or inflammatory conditions. The stools in Diarrhœa generally differ from those of cholera, in containing more albumen; except, perhaps, in the Diarrhœas produced by hydragogue purgatives. The consistence and color of the discharges vary considerably; they may be pultaceous, or as thin as water, or in any intermediate state—the color is often affected by the proportion of biliary matter, a deficiency of this making them pale; but it also depends upon the color of the secretions themselves and upon the chemical changes going on within the intestines or in the feces after voiding. The loose evacuations of young children are often drab or yellow on being passed, and become quite green an hour or two after exposure to the air. When the stools are liquid they separate, on standing, into a fluid and a sedimentary portion; the sediment containing matters, microscopic or otherwise, indicative of mucus, pus, fibrine, and of the debris of food. The smell of diarrhœal matters may be more or less fecal; they may be without much smell of any kind; but in some cases they are more or less offensive or fetid. The chemistry of diarrhœal discharges requires further investigation. It is possible that due research would show that they contain unknown or unsuspected compounds, which would throw light on the diagnosis and the nature of the disease.

Diarrhœa, as will be seen from the above, may be beneficial by freeing the intestines from noxious matters, or by purifying the blood; but if protracted it is always hurtful; the drain of matter from the blood which attends the eliminating act, in the course of time impoverishes it, and all the evils of extreme anæmia come on, and terminate life. This is the case with most chronic Diarrhœas. They may last for months or years and produce exhaustive effects very slowly, but nevertheless progressively. In some of these cases the discharges will probably not be at all copious or frequent, so that the patient's nutrition is not rapidly interfered with. Ultimately, however, the balance between nutrition and drain is lost, and he succumbs. In a certain limited number of persons, Diarrhœa is habitual. Some of these have one or two loose motions daily, for years, without their nutrition suffering much. In

these it might be well not to interfere with their condition. They are very rare however.

Diarrhœa in children is readily brought on. It is often very tedious, and frequently dangerous both in the acute and chronic forms.

The influence of Diarrhœa upon life varies greatly in different countries, seasons, and periods, and according to age. The annual mortality of Diarrhœa is greater in hot than in cold climates. In the Indian Sanitary Report it is set down at eighty-six per million in England for seven years, 1848–54, and at 4,555 per million for European troops in Bengal for the fifteen years, 1830–45. In the Indian returns, without doubt, many cases of dysentery are recorded as Diarrhœa. The difficulty of diagnosis is great, and there is much probability that considerable error has arisen from this circumstance; but, after making due allowance for this, there is much greater annual mortality from Diarrhœa in hot than in cold climates, and in the summer seasons of temperate climates than in the winter.

The influence of age is shown in the greater liability of young children than adults. The cases and mortality of children under five years of age are much greater than in subsequent ages; but, as Dr. West has shown from the records of the Children's Infirmary, the period of greatest liability is during the period of dentition—from six months to eighteen months or two years of age.

ETIOLOGY.—From the difficulty of distinguishing between Diarrhœa and dysentery it may be supposed that the army returns from our foreign stations are not always to be depended upon for showing the proportional prevalence of these diseases; and therefore, in considering the causes of Diarrhœa, it will often have happened that the causes of dysentery have been considered at the same time. As remarked by Dr. Ewart (Vital Statistics of the Armies in India), it is probable that it is owing to difference in diagnosis that the relative prevalence of dysentery and Diarrhœa in India appears to differ so much in present and past times. In England there is less room for mistake.

In studying the causes of Diarrhœa we find that a considerable number of them consists of irritating substances introduced into the alimentary canal, but that by far the most important diarrhœas are expressive of constitutional derangements. Among the causes which act locally, we may place *indigestion*, *indigestible food*, *impure food and water*, *irritating matters or secretions* poured into the bowel, *entozoa*, &c. Those due to constitutional derangements may be secondary to such diseases as *tuberculosis*, *pyœmia*, *albuminuria*, *hepatic diseases*, diseases producing cachexia, as *chronic malarious complaints*, with *enlarged liver and spleen*, *cancer*, *scurvy*, *anœmia*, *degeneration of tissues of the mucous membrane of the small intestines*, *disturbances of the functions of other organs giving rise to vicarious fluxes*, *enteric fevers*, *gout*, &c. In these the Diarrhœa is symptomatic, but in other instances the causes seem to act more directly on the mucous membrane, giving rise to fluxes without any traceable intermediate diseases, as in the operation of heat, cold, damp, vitiated atmospheres, septic foods and water, and unknown atmospheric influences—some of these probably act through the nervous system and some through the blood.

It is a matter of observation that all cachectic influences have a tendency to produce Diarrhœas; hence we find that in a very large number of exhausting chronic diseases there is Diarrhœa before death, even although there may be no specific morbid matter to be eliminated, as in the case of enteric fever, tuberculosis, or albuminuria. As the cachexia increases, the blood becomes more and more loaded with effete matter, and the surface of the small intestines becomes the channel of purification by means of Diarrhœa. It may be a matter of doubt how far the cachectic state may be an exciting cause, by requiring matter to be eliminated in the same way as would any inorganic poison introduced into the blood; or whether this state of the blood merely predisposes the system to Diarrhœa under such exciting causes as local irritants, and the external agencies of cold, damp, and vicissitudes of temperature; certainly any of the ordinary exciting causes of Diarrhœa acting upon individuals in the circumstances above mentioned, will speedily give rise to alvine fluxes. Still, it appears probable that in a certain number of cases the causes act directly as before said, rapidly or slowly causing blood changes. Of course it is very difficult to trace the precise action of the causes in many cases, and without doubt in many we mistake between the predisposing and exciting causes. Diarrhœa often prevails in malarious countries without preceding obvious cachexia, and its mode of production in them affords matter for discussion. It is doubtful whether it arises directly from the action of malaria, or whether this acts merely as a predisposing cause, by which the system becomes readily susceptible to the external impressions causative of Diarrhœa. The high authority of Dr. Morehead is in favor of the view which restricts malaria to a predisposing action only; but with due deference to his opinions, the writer finds it hardly possible to escape the conclusion that in a certain number of cases the flux may come on in an early stage of contamination of the

system, before recognizable cachectic influences appear, and where external impressions are not traceable.

[In most of the later statistics of the United States Army,[1] Diarrhœa is taken along with dysentery, as coinciding generally with that disease in its prevalence in different regions. As a rule, the number of cases, and the mortality, have been greatest in the more southern U. S. Departments. Taking the country throughout, during the Civil War, there were, for white troops, one case of chronic for every six cases of acute Diarrhœa, and one case of chronic for every nine cases of acute dysentery. Amongst colored troops, one case of chronic to every nine of acute Diarrhœa, and one case of chronic to every nine of acute dysentery; for white troops, one death to every three hundred and ninety-five cases of acute Diarrhœa; one to every fifty-seven cases of acute dysentery; one to every six of chronic Diarrhœa; and one to every eight of chronic dysentery. Of colored troops, one death to every eighty-three cases of acute Diarrhœa; one to every seventeen of acute dysentery; one to every four of chronic Diarrhœa; and one to every four and one-half of chronic dysentery. Amongst the troops of the Confederate army, according to Dr. Joseph Jones,[2] the ratio of cases of Diarrhœa and Dysentery to the total number of cases of disease was about the same as in the United States army; but the ratio of deaths from Diarrhœa and Dysentery to all deaths from disease was very much smaller in the Confederate army.—H.]

In Europe, Diarrhœa, sometimes called sporadic or bilious cholera, or summer Diarrhœa, prevails endemically at certain seasons, especially in the summer or autumn months. It has sometimes been set down to various causes—as heat, heat alternating with cold and damp, checked perspiration and disordered hepatic secretion, and the use of fruits. It is probably due to some atmospheric state; the air being rendered impure by numerous causes in operation, producing miasms, which may be either predisposing or exciting causes in seasons in which the temperature, though high, often varies considerably. Fruit has probably little influence beyond that of an occasional determining cause. Irritative Diarrhœa may be produced by eating too much fruit, but not the genuine severe summer Diarrhœa. Apart from the annual prevalent summer Diarrhœa, in certain years, alvine flux appears to prevail epidemically in England. Thus, in the five years ending with 1848, the deaths in London from Diarrhœa amounted to 7580, whereas for the five years preceding these they were only 2828 (Report of Board of Health for 1848–49). This shows that the constitution of the years preceding cholera seems to favor the development of alvine fluxes. A great increase of diarrhœal complaints in like manner preceded the advent of the cholera epidemic of 1832. The mortality from Diarrhœa was unusually large in England during the summer of 1865 (*Lancet*, July 22, 1865). Although we cannot tell what may be the exact causes of these endemic or epidemic fluxes, we find that they are generally much more rife in the hot than in the cold seasons of England, and that the same kinds of atmospheric conditions which favor the spread of Asiatic cholera seem to promote the increase of Diarrhœa. It is true that with high ranges of the thermometer Diarrhœa is nearly always prevalent, but it would be wrong to suppose that heat alone would cause it, neither would great cold. Alternations or sudden changes of temperature may do so, as when the days are hot and the nights cold, especially when there is a predisposition. The Diarrhœas of hot climates are not due to heat alone, nor do they prevail in the hottest and dryest part of the year. They depend probably upon several causes combined, such as impure air, malaria, improper food and water. Dr. Ewart's tables show that the European soldier suffers more than the native soldier, while the European officer does not suffer more than the sepoy.

Vitiated and Impure Air.—The influence of this in the production of Diarrhœa may be seen in large standing camps. After a few days' residence, when the conservancy is bad, looseness of the bowels is very prevalent. Medical students and others, who spend many hours daily in the dissecting room, often suffer from Diarrhœa. There are many instances of the production of Diarrhœa when people have been exposed to a concentrated foul atmosphere, by standing close to the mouths of newly-opened cesspools, also in those exposed to the emanations of manure manufactories when the wind blew from them towards the sufferers, in those within the reach of the atmosphere of bad graveyards, and indeed to those within the influence of miasms, arising from sewage, fecal collections, and decaying animal matter, generally. The records of hygienic medicine abound with evidence of these facts.

Indigestible, unusual and impure food, is a very frequent cause of Diarrhœa. The Madras sepoys, stationed on the Tenasserim coast, used to suffer dangerously from chronic Diarrhœa, attributed to changes of diet, and it is well known that the regiments of native infantry, sent

[1] Woodward, op. citat.]

[2] Richmond and Louisville Medical Journal, Oct. and Nov. 1869, March and June, 1870.]

from the upper provinces of Hindustan, on their tour of duty in Bengal contract Diarrhœa after a few months' residence in the lower provinces, and suffer considerably therefrom. They exchange the wheaten part of the diet, used by them in Hindustan, for one made up largely of rice, which they find cheaper. In these cases it is not to be supposed that the Diarrhœa is produced by mere irritative causes of unusual food, though this has an influence, but by the gradual deterioration of health, sometimes through scurvy, which requires flux for elimination of morbid matters, or makes the people more readily fall a prey to exciting causes. All large collections of people, as prisoners in jails, &c., suffer from Diarrhœa, and often fatally, when food, water, and air are bad. The evil effects of unadapted diet are shown in the excessive mortality from Diarrhœa in infants and young children who are fed improperly, or brought up by hand, as in some foundling hospitals. It is rare for the child of an Indian wet-nurse to live after its mother has separated from it. Diarrhœa often destroys the infants of wet-nurses in England also. A nurse with bad milk generally induces Diarrhœa in her suckling. The injury of improper diet is also shown by the great mortality from Diarrhœa among the children of the manufacturing populations of the large towns in England. This is well illustrated in Dr. Greenhow's Report to the Privy Council for the year 1861.

Bad Food is often combined with insufficient food, and this last alone, even where the quality of the food is not altered, appears to be sufficient to cause Diarrhœa. This was shown at the Millbank Penitentiary in 1823, when the prisoners had their food reduced from 31 to 33 ozs., to 21 ozs. of solid food daily, with an almost entire exclusion of animal food. The health of the inmates gave way in a few months, Diarrhœa, dysentery, &c., then came on, preceded by signs of deteriorated health (Carpenter's Physiology, 6th Edition, page 57). Diarrhœa frequently attends starvation, and, as remarked by Dr. Carpenter, in the chronic inanition which attends many lingering diseases, the badly nourished tissues furnish the blood with rapidly decomposing materials, and thus cause colliquative Diarrhœas. Bad cooking in large establishments has been known to produce Diarrhœa.

Impure Water. — This is an efficient cause. When water contains much saline matter, it causes looseness of an irritative kind, especially to newcomers into a district supplied with such water. In the process of time they may become accustomed to it and not suffer from it. Water contaminated with decomposing animal matter, or with sewage or sewage gases, is pretty certain to cause Diarrhœa, either quickly or slowly, according to the degree of vitiation of the water and the mode in which it is used. Dr. Parkes mentions that probably 3–10 grains per gallon of putrescent animal matter may suffice to render water hurtful. When Diarrhœa prevails over a limited district, or in a few houses, or in a single house, the water will very frequently be found to be the cause, and the supply should be submitted to close examination. Water rendered impure by animal matter may cause Diarrhœa by direct irritation, but more probably by the septic matters absorbed into the blood. The Hill Diarrhœas of some of our Himalayan stations have been attributed to the water, but Dr. A. Grant thinks that though this may have some influence, it is only in combination with impure air and malaria. [Water of limestone regions not unfrequently causes Diarrhœa in travellers from other places accustomed to drinking only soft water. A good preventive of this effect is the addition of four or five drops of tincture of ginger to each tumblerful of the water. In and near the great Western "alkali flats" of North America, an excess of soda in the water makes it sometimes undrinkable; or, if usable at all, irritating to the stomach and bowels. Lemon juice, or diluted vinegar, will to a considerable extent antagonize this action.—H.]

Bad dwellings, or habitations which are damp, cold, dark and unventilated, and which are too near the ground and badly drained; and *insufficient clothing*, should all be considered as causes of Diarrhœa.

The seasons in which Diarrhœa prevails most in Europe, are in the summer months; from June to September, or earlier in the year if the temperature is unusually high. The same law operates in the case of children, as was observed during eight years in the London Children's Infirmary (West, Diseases of Infancy and Childhood). In India, Diarrhœas prevail in the rainy season, and not seriously in the hot and dry months of the year. Bowel complaints are very frequent, however, in the cold season in Bengal and in Bombay. This applies both to natives and Europeans. It is very probable, as supposed by Dr. Morehead, that in the cases occurring in the cold season, the cold and damp weather act as exciting causes upon cachectic persons.

[In the United States army during the civil war, in the Atlantic, Central, and Pacific regions, Diarrhœa, like dysentery, prevailed most extensively in summer and autumn. The same is undoubtedly true, in this country, in civil life. The difference is most marked in large cities, and in children.—H.]

In summing up the causes of Diarrhœa, we find them to be—

1. Such as produce direct irritation of the bowels.

2. Such as, by rendering the blood impure through primary diseases, produce Diarrhœa as an eliminating flux; or render the body more susceptible to the action of exciting causes.

3. Such as act directly on the system through cold, heat, impure air, malaria, crowding, bad or insufficient food, or water; and which determine an eliminating Diarrhœa; or act, as in the case of vicissitudes of temperature, through impressions upon the nervous system only.

Forms and Symptoms.—We need not consider more than the following forms.

1. Irritative Diarrhœa.
2. Congestive and Inflammatory Diarrhœa.
3. Summer Diarrhœa.
4. Chronic Diarrhœa.

1. *Irritative Diarrhœa.*—This depends upon the action of matters which have in some manner entered the intestines. The common feculent diarrhœa is an example of its milder form.

The irritating matters may be indigestible or undigested food, badly cooked or diseased or putrid food, shell-fish, mushrooms, fruits, and vegetables, diseased secretions from the intestinal walls, and secretions from ulcers in any part of the alimentary canal above the lower end of the ileum, irritating matters poured into the bowel, as in the case of vitiated biliary secretions, abscesses opening through the intestinal walls, entozoa, purgative medicines, and irritant poisons. These have various degrees of effect.

Common feculent Diarrhœa.—In this, a few hours after a meal, the patient feels colic and flatulence, and a desire to evacuate the bowels. There is often nausea and a foul tongue, seldom vomiting. The pain is often relieved by the purging which ensues. The stools have a feculent character and are of brown fluid containing lumps of feces, often offensive. The color becomes lighter after four or five evacuations, and if the disease goes on may end with mucous stools, but generally the looseness passes away after a few motions which have removed offending matters. The pulse and the strength do not change, or but slightly. The milder irritants may excite this form of purging. It is sometimes caused by overeating, or eating too rapidly, independently of improper articles of food, or by temporary states of indigestion due to fatigue, or other disturbances of digestion which interfere with the proper chymification of the usual diet. It may sometimes be prolonged by continuance in excess of food. In some plethoric persons, Diarrhœas of this sort seem to be excited by critical irritating discharges from the intestines themselves.

Much more severe symptoms attend when the irritating matters are diseased or putrid food or water. The Diarrhœa is more violent and exhaustive, the constitutional depression very decided, as shown in the feeble pulse and coldness of surface. The stools may be offensive at first, and attended with much flatulence, and the disease may continue after the offending matters are expelled, owing to induced inflammation of the mucous membrane, which may cause organic changes. The symptoms of this form are probably not always due to purging only, but also to the septic influences of the decayed ingesta. These cases resemble the milder forms of cholera in the violence of their symptoms. They generally recover in a day or two.

Lienteric Diarrhœa.—In this form of irritative flux there is, with the frequency of evacuation, a want of assimilation of food, which passes through the intestines more or less unaltered, and causes irritation in its passage. This is usually associated with the chronic forms of the disease, and may complicate all of them. The Diarrhœa is not always due to the state of the ingesta only, but often exists as a separate complaint; and indeed often causes the imperfect assimilation by its debilitating influence upon the general system, and on the process of digestion; in these cases the disorders of the stomach and of the bowels act and react injuriously on each other. In lientery the stools are frequent, mucous or serous, more or less covered with bile, or of buff color, or straw color, or grayish, and mixed with undigested food. In young children this is frequently seen both in acute and chronic Diarrhœa, the stools being composed of unchanged casein. In some cases the food is partially assimilated, or some kinds of food are acted on while others are not at all changed. In lientery the patient emaciates rapidly, although he may have a good and even large appetite. The drain and the absence of nutrition both contribute to reduce him. Even that portion of the food which may be digested is hurried onwards owing to the irritable state of the muscular fibre, so that little or no absorption can take place, and thus the supply of nutriment available to the system is reduced to a minimum.

Bilious Diarrhœa.—This may be acute. Excessive biliary secretion is said to be the irritating cause. The patient passes frequent bilious motions, has scalding sensations at the anus, and griping pains. The motions are frequent, green, or yellow, and if the disease continue three or four days, like other varieties of irritative Diarrhœa, it is liable to pass into the congestive or inflammatory forms, and the motions may contain much mucus.

This form of Diarrhœa, due to the direct irritation of biliary secretion, is perhaps not so common as is supposed by some writers. In hot climates it is probable that the so-called bilious Diarrhœa is really dysentery rather than an affection of the small intestines. Even in this, however, the secretion of bile in excess is rather secondary to intestinal irritation than a cause of it. The flow of bile is readily excited by reflex action when the intestines are irritated. Still, without doubt, Diarrhœa may be caused by excessive biliary secretion, and sometimes this does exist as an irritating cause, and does produce the effects just mentioned.

In climates in which liver diseases are frequent it is always necessary to look to the condition of the liver in cases of Diarrhœa which are at all protracted. It is probable that Diarrhœas, due to vitiated bile, are not nearly so frequent as is supposed, but still we often find deranged biliary functions with Diarrhœa, and should always remember the connection and investigate the state of the liver in all cases of intestinal flux. Diarrhœa sometimes exists with suppuration in the liver, but it is doubtful whether any particular form of the flux is so associated. Dr. Parkes thinks that copious, yeasty, light-colored stools are often met with in liver abscess. Annesley mentions dark-colored stools. It is probable that no particular form of flux is diagnostic, but whenever we find a continuance of the stools before described, we should always be alive to the possibility of hepatic disease.

Entozoa.—Diarrhœa does not necessarily occur with these, but they give rise to it occasionally, especially in India, and should always be thought of as a cause in obstinate and obscure cases. It is more particularly active in children. The lumbrici apparently irritate the bowels more than the tape-worm, but this last does so occasionally. It may be that this appears so, simply because the lumbricus is more common than the tape-worm. In these cases the stools contain mucus. This is not always the case, but when there are mucous stools without the symptoms which generally attend the sub-inflammatory forms of Diarrhœa, we should do well to suspect the presence of entozoa. Trichinæ cause Diarrhœa, but other symptoms ensue which soon throw the Diarrhœa into the shade.

It is clinically important that we should recognize Diarrhœa from the irritation of *morbid substances poured into the intestines*, as from abscesses or other fluid collections opening into it. This is more frequently seen in India than in Europe. In India an occasional cause of Diarrhœa is the opening of hepatic abscesses into the small intestines. A sudden and perhaps profuse evacuation, preceded perhaps also by some relaxation of the bowels, should cause suspicion of the opening of a large liver abscess, but the particular diagnosis of this refers rather to that of hepatic disease than to Diarrhœa.

Any of the irritative forms of Diarrhœa may pass on to chronic Diarrhœa by exciting permanent disease of the intestines; or may be prolonged owing to a continuation of the exciting causes, as in the cases of bad diet, bad water, &c., and which would cease on removal of such sources of irritation.

2. *Congestive or Inflammatory Diarrhœa. The Mucous and Serous Diarrhœa of some writers.*—Any of the forms of Diarrhœa before-mentioned may give rise to organic disease of the mucous membrane by originating congestions or inflammations, ulceration, &c.; but these changes may also arise from constitutional causes, such as exposure to cold, checked perspiration, miasmatic influences, independently of local irritations, and be the sources of the serous, mucous, and fibrinous discharges which characterize these forms. The milder forms of inflammation are classed under Diarrhœa, though they would be more properly placed under the head of sub-acute or chronic muco-enteritis, but as the flux is the principal symptom, they are often described under Diarrhœa. Anatomically, the parts involved are the mucous membranes, glands, and follicles. The stools in this vary considerably in character. In the early stages they may be liquid or albuminous, or be a mixture of mucous and watery fluids; sometimes they are called serous. At times they contain glairy and opaque or stringy mucus, or consist mainly of mucus with some fecal matter, and occasionally fibrinous or flaky masses. The stools may be frequent—three or four to ten or twelve in twenty-four hours. They are rarely offensive. They may be copious in the watery forms, but are often not large when they are chiefly mucous. There is more or less constitutional disturbance, slight quickening of the pulse, with slight or no febrile reaction. The abdomen feels sore on pressure, and is sometimes somewhat distended. The tongue may be reddish, but at other times not altered. The patient often complains of griping, gnawing, or pricking pains. There is loss of appetite, or nausea. In a few days the disease generally yields, if not, the patient emaciates; so, if the disease passes into a chronic state, the skin ultimately becomes harsh and dry, and as the complaint proceeds there is often great exhaustion, and it may be fatal with the usual symptoms of chronic Diarrhœa. In young children it is often fatal in the acute stages; the evacuations are frequent, copious, thin,

glairy, perhaps tinged yellow. In many cases there is much straining, and blood appears in the stools. These last are cases of dysentery rather than Diarrhœa, but in the beginning there is extreme difficulty in knowing what the disease is to be, and indeed the diseases are much mixed up together. In the diarrhœal form exhaustion soon comes on if the disease is not checked, and death may take place in three or four days. This is called "watery gripes." It may pass into a chronic state in the child as well as in the adult. In some instances of the inflammatory Diarrhœas, ulceration may be diagnosed in the protracted cases by small masses or striæ of blood being found in the discharges. They would probably be more frequently found if the sediments of the stools were more commonly submitted to microscopic examination. In typhoid fever ulceration sometimes gives rise to decided hemorrhage. In some of the more chronic forms of these Diarrhœas the discharges are quite pale, and some writers supposing that this is due to excessive secretion from the mucous follicles, have called it *Chylous Diarrhœa.* It is probable that in these cases there is imperfect or deficient secretion of the bile, as well as unabsorbed chylous matter (Copland's Dictionary). [Although some masses supposed by the ancients to be oleaginous are now known not to be of that nature, there is no doubt that fatty matter is sometimes passed in the stools of Diarrhœa and dysentery. The *corpora pinguia*, described by Aretæus as resembling chapped tallow, were probably such in part. Certain small masses, somewhat like frog's spawn, have been noticed by a number of recent pathologists, which, however, appear to be chiefly composed of particles of starch derived from undigested food. Woodward reports them to have been not uncommon in acute dysentery, and in the chronic fluxes, in cases observed during the civil war. Sauvages proposed the term *Diarrhœa adiposa* for the affection in which the discharge of oil or fat is a symptom. The origin of this material, present more often in Diarrhœa than in dysentery, has been considerably discussed. Some have ascribed it altogether to food, imperfectly assimilated; others, as Kuntzmann (1824), Bright, Lloyd, and Elliotson, have accounted for it by the coincident occurrence of disease of the pancreas; and a third class, as Pearson, Eisenmann, and Reeves,[1] point to disorder of the liver as, in some instances at least, its most probable cause. Yet Prout, Gull, and others have reported cases in which fatty stools occurred in the absence of any disease either of the liver or the pancreas.[1] On the whole, we must conclude that several different kinds of disorder of the organs connected with digestion and assimilation may, under circumstances not yet well defined, induce the appearance of fatty matter in discharges from the bowels.—H.] In some cases there is fibrinous exudation which takes the shape of the surface from which it is exuded, and thus complete cylinders or casts of portions of the small intestines may be formed. These are sometimes several inches long, are of considerable consistence, and may be thicker than the coats of the bowel itself. Dr. M. Good has called the disease *Diarrhœa tubularis* when the exudation is thrown off and appears in the stools in a cylindrical form. [See DYSENTERY, *ante*.—H.] More frequently, membranous patches are detached, and occasionally long-standing looseness, griping, &c., cease immediately after the expulsion of a piece or two of this membrane, which while attached to the surface of the mucous membrane had probably caused the symptoms.

These inflammatory conditions of the mucous membrane may, as before said, be caused by persistent local irritation, or by any of the primary diseases, or by the various external agents before mentioned. The disease may yield in the early stages, but on the other hand the most grave consequences, such as thickening, ulceration, and contraction may ensue, and the Diarrhœa become chronic. In the nature of the discharges these forms of Diarrhœa so nearly resemble those of dysentery that it is often impossible to distinguish one from the other, especially in the chronic stages, and indeed it seems that in young children both the small intestines and the colon are often simultaneously involved.

3. *Summer Diarrhœa. Sporadic Cholera or Bilious Cholera.*—This form is generally met with in the north of Europe in the summer months, from June till the end of September.

The disease generally sets in suddenly. There is vomiting and purging. The vomiting is copious. The stools are also copious and watery, and often expelled with force; they are generally loaded with bile, and of dark brown or green color, as are the vomited matters after the stomach has been cleared of food. There

[1] Cited by Woodward, op. citat., p. 379.]

[1] Bidie (Edin. Med. Journal, iii. 1857–8, p. 149) found fat in the passages of soldiers suffering from acute Diarrhœa in India. Woodward quotes Heinrich and Bouchardat as having observed fatty discharges in diabetes mellitus; Heinrich, in phthisis; Zimmermann in typhoid fever; Lauer Lindsay in cholera; and Widerhofer in chronic (especially tubercular) intestinal diseases of children.—H.]

is much painful contraction or cramp of the muscles of the abdomen, of the muscles of the extremities and of the bowels, recurring frequently. The tongue is dryish and there is much thirst. Exhaustion comes on rapidly in this disease, so that in a few hours the pulse, though firm and even full at first, will have sunk, the voice have become feeble, the skin bedewed with cold or clammy perspiration, the temperature of the body reduced, and a sense of sinking and faintness will be established. In severe cases symptoms of decided collapse succeed, and the patient may die. The disease is not so rapid as Asiatic cholera, and the mortality is small. People seldom die under two or three days of illness, but in extreme cases it has been fatal within twenty-four hours. The urine is seldom quite suppressed. In some cases gastro-enteric irritation or some febrile disturbance follows the attack. As far as symptoms go the disease is not so violent as Asiatic cholera, but they seem to differ rather in degree than in kind.

Although the relation of this disease to Asiatic cholera has not been made out, it is impossible to avoid speculating on the resemblance between them. The presence of bile in the stools, the greater griping, the longer duration of the disease, the non-suppression of urine, and the smaller fatality, seem to be the only points which distinguish summer Diarrhœa from epidemic cholera. These differences are not so obvious in all cases, and in some of the worst forms of the English disease the complaint would at once be recognized as real cholera if it occurred during an epidemic of Asiatic cholera. True choleraic Diarrhœa often continues for days with bile in the stools, and may ultimately pass into real cholera. Mild Diarrhœas of bilious character are frequently met with in the summer months in Europe. They last a few days, and are generally amenable to treatment. It will not be necessary to say more about them.

4. *Chronic Diarrhœa.—White Flux.—Cachectic Diarrhœa.*—It will be sufficient to speak of the chronic forms of all the foregoing varieties of Diarrhœa in one section, and in this also to include the insidious forms of Diarrhœa which begin without acute symptoms, and which, from the paleness of the stools, are sometimes called *White Flux.* The tendency of all chronic Diarrhœa is to destroy life by anæmia and exhaustion, so that in describing the so-called white flux the progress of the others will be illustrated.

Chronic Diarrhœa, beginning insidiously, is not uncommon in India, nor probably in other parts of the world. It attacks Europeans and natives, and is not confined to people in poor circumstances. There is no protection in length of residence; indeed, the old European residents suffer more than new arrivals. Deterioration of health from climate favors the disease known as white flux. Though called white, the evacuations are not often very white. They are very pale, however, especially after they have lasted any time. This flux probably arises independently of local irritation, though it may be aggravated by such. It has a dangerous tendency when firmly established in the system, though it may take months or years to run its course. At times it progresses more rapidly. It is often met with in people who have in some way suffered from malaria, but it also attacks those who do not show decided signs of it. A somewhat similar disease prevails in the Indian Hill stations of Simla, Kussowli, and Dugshaie, but those of Darjeeling, Nynee Ial, and Mussourie, seem to be free from it. It is probably due to the direct or indirect action of malaria acting feebly and slowly on the system.

This dangerous disease begins without marked symptoms beyond those of relaxed bowels. There may in some cases, even at first, be only two or three stools in the twenty-four hours, and the patient may pay little attention to them. They may be more frequent than this, however, and may vary from slightly loose and pultaceous motions to copious and fluid ones. They are generally yellow, light yellow, or pale drab or whitish in color. When liquid, there is not much sediment, and little or no mucus; they are often passed with force. As the disease advances the paleness of the evacuations is more constant, and sometimes they have the appearance of chalk and dirty water, are very liquid and frothy; sometimes they are of the consistence of thickish gruel. There are generally several evacuations in the twenty-four hours. In one case I saw but one motion in twenty-four hours, but that was large and expelled with force. In no single case are the evacuations always of the same character. They frequently vary within certain limits; but it may be said that in the established disease they are more or less pale or approaching to whiteness, and more or less liquid, becoming lienteric and sometimes dysenteric, in the later stages, if the colon becomes implicated, as may happen. The cases vary in their associated symptoms. In some, dyspeptic symptoms are very troublesome. The tongue is sore, smooth, and shining, and perhaps studded with small aphthous ulcers, which may also attack the lips. The patient complains bitterly of the feeling of soreness in the mouth, and of the pain in eating or drinking. The abdomen is often distended with gas, and distressing flatulence and colic follow every meal. The appetite is

often considerable, very capricious, and there is a craving for unsuitable food, which is often indulged in, in spite of the most serious warnings. In other cases the dyspeptic signs are not severe, the tongue is pale and soft, the abdomen flat or but little distended. Although in some cases the appetite is great, in the majority of cases it is lost or indifferent. In general there is not much or any pain; the characteristic feature being that of paleness, emaciating, exhausting Diarrhœa. In the advanced stages the temper becomes irritable, the pulse thready but not always quick, sometimes indeed slow; the skin generally harsh and dry, parchment-like, or in others soft and silky, and very often brownish or darkish in hue, or the tint of the brownish skins deepened. With all this, emaciation progresses as does failure of bodily strength. Great anæmia follows, as shown by the pearly eye and bloodless conjunctiva, the pallor, and the dropsical swellings. Articular pains without swelling, and scorbutic patches, occasionally appear, and in the natives of India ulcerations of the cornea. The patients die with more or less anasarca, creamy exudations on the tongue and inside of mouth; sometimes with coma or convulsion, and occasionally from syncope during slight exertion. When recovery takes place there is great risk of relapse under exposure or other exciting causes.

It is difficult to tell the exact mortality of this disease. It is considerable in the confirmed cases.

The paleness of the discharges has obtained for this disease the name of white flux, though probably the term Diarrhœa alba has been differently applied by different authors. This paleness has led many to think that the exciting cause of the disease is the state of the liver secretion. It is probable that too much importance has been attached to this as a cause of the flux, and that the liver derangement is merely a part of the great general disease which gave rise to blood changes. Without doubt, an absence of bile in the upper part of the canal interferes greatly with the digestive processes, and thus the Diarrhœa may be aggravated in the same way as it is when the stomach digestion is imperfect, and therefore it is of importance that the biliary secretions should be restored. We must remember, however, that in judging of the action of the liver the coloring matter is not the certain measure of the quantity of biliary acid secreted, and we should, in estimating the quantity of coloring matter, recollect the quantity of liquid and the color of the secretions with which it may be diluted or mixed. There can be little doubt, however, that there is a deficiency in the coloring matter of the bile. It may be noticed that in all forms of chronic Diarrhœa there is a tendency to paleness of stools as the disease advances.

It is not improbable that there may be more than one form of chronic constitutional Diarrhœa in India and elsewhere, but in the majority of cases it will be found that they are secondary to scurvy, recognizable malarious disease, etc.

Hill Diarrhœa.—Under the name of this, and of Diarrhœa alba, passing into Diarrhœa cum cachexia, or cum anæmia, Surgeon-Major Alexander Grant has described the disease of the Indian Hill stations, which resembles in so many particulars the white flux of the plains. This valuable paper is to be found in the first volume of the "Indian Annals," and should be carefully perused.

Dr. Grant thinks that there is more decided derangement of the functions of the liver in the hill disease than in that of the plains. The stools are pale-drab or muddy-gray color, frothy, and feculent in the early stages; but they are often very white. In later periods they become yeasty, pultaceous, or lienteric. The stools are generally passed between daylight and breakfast time, and again as evening approaches. Their odor is peculiar and unnatural, but not offensive. The digestive organs are disturbed in the same way as they are in the plains. If the disease advances unchecked, anæmia and exhaustion occur. It may last for years, but is generally relieved in the early stage by medicines or by change of residence to the plains; but it may require change to Europe. It is dangerous when very chronic or confirmed, and shows a strong tendency to relapse. This relapse often occurs after removal to the plains. Dr. Grant notices this as having been the case in regiments moved from the hills to the lowlands. The surgeons who were with the army of the Punjab in 1848–49 will remember how severely the men of H. M. 29th, the 2d Europeans, and the Bengal Artillery suffered in the plains, after having, previous to joining the force, been subject to the disease in the hills.

Dr. Grant attributes the disease to ordinary external causes, but thinks that they must be conjoined with malaria. He says that the disease begins about the time that the rains set in, "At the time when the air, from being dry and warm, becomes moist and cool, and from the hot steaming ravines and valleys heavy vapors ascend and envelop the stations. The nights are cold as well as damp, and exposure to night air causes hepatic congestion and functional derangement."

Morbid Anatomy. — The morbid changes are various. In the *acute* form

little or no structural changes may be found, except perhaps some patches of congestion or slight vascularity. In the cases of young children dying of the inflammatory forms there may be some swelling of the follicles and of Peyer's patches. In the *chronic* forms there may not be much surface change except in the inflammatory varieties. There may be traces of redness in patches, ulceration of the glandular structures, with the floors in various stages of repair, grayness of portions of the mucous membrane, black or dark margins to the ulcerated tissues or healed ulcers, puckering and contraction. In some chronic Diarrhœas, especially in those with white flux, in spite of the long duration of the disease, little or no change of the mucous surface is to be found. There is a great thinning of all the coats of the small intestines, so that they are quite translucent. There is doubtless atrophy of the glandular tissues. These remarks also apply to the state of the intestines in Hill Diarrhœa. When these patients have had dysenteric symptoms towards the close of life, ulceration or sloughing of portions of the colon may be found in them. The mesenteric glands are generally enlarged and hardened in all chronic Diarrhœas, and especially in the white flux. The liver is not necessarily altered even in the Diarrhœa with white flux. It has been found flaccid and anæmic and small, or of natural size, and without any decided morbid appearance. It occasionally presents patches of fatty degeneration, but this is not peculiar to chronic Diarrhœa.

In some cases of chronic Diarrhœa, some tissues of the small intestines are found in a state of amyloid degeneration. Dr. Aitken, in post-mortem examinations of invalids at Fort Pitt and Netley, has often seen this degeneration involving entire villi, points of villi, mucous and submucous capillaries, and the vessels surrounding the sacculi of Peyer's patches, also in a state of annular infiltration round solitary glands. In these cases it was probably associated with similar degenerations of other organs. It would be well to study carefully the condition of the tissues of the small intestines as to degeneration in the Diarrhœa with white flux, and indeed in all the chronic forms of the disease.

[Dr. Woodward[1] reports that neither in the U. S. Army Museum, nor in any of his autopsies during the war, has he met with a single case of Diarrhœa in which the small intestine alone was involved. In many instances of fatal Diarrhœa, acute and chronic, numerous pigment deposits were observed, both in the villi of the small intestine and in the patches of Peyer. Thus was produced, in the latter, what has been known as the "shaven beard" appearance of the mucous membrane. The large intestine presented in many cases diffused or localized hyperæmia; in some, positive inflammation; often, enlargement of the solitary glands; and in a certain number ulcers, especially in cases of a decidedly chronic course. According to the numerous and careful autopsies of Prof. Leidy, however, in the majority of cases of Chickahominy Diarrhœa the affection of the intestinal mucous membrane did not progress to the stage of ulceration.—H.]

DIAGNOSIS.—Due attention to the history and symptoms will generally enable us to distinguish between the different forms of Diarrhœa. There may be difficulty at the onset in deciding between Diarrhœa and cholera, when the latter disease is epidemic. Information on this point will be found in the article on Cholera.

Some of the forms of dysentery are frequently mistaken for Diarrhœa. In these cases of dysentery the motions are copious, liquid, deep brown, or brownish yellow, and there is straining and griping. These may pass on to a fatal termination without any masses of mucus or blood being discovered by the ordinary way of inspecting the evacuations, and hence the error. It is chiefly in the beginning of these cases that the error occurs, and between them and bilious Diarrhœa. One may feel pretty sure, however, that in tropical climates, in cases in which there are frequent liquid evacuations, with some griping and straining, these are dysenteries, and of a dangerous character. In them there will probably be found some soreness and fulness on careful pressure over the cæcum and sigmoid flexure, which will not be present in Diarrhœa, but this is not always to be made out satisfactorily. In dysentery, by washing the evacuations so as to get rid of all the coloring and fecal matter, we shall find at the bottom of the vessel more or less reddish or bile-stained mucus in flocculent masses or flakes or strings. This will scarcely ever be found in Diarrhœas, except, perhaps, in those dependent on recognized fevers. Otherwise, mucous Diarrhœas are rare in adults in India.

In deciding between chronic Diarrhœa and chronic dysentery we should always study the history, and we shall probably find that those cases in which there has been an absence of mucus and straining in the early stage are Diarrhœas. In chronic dysentery the mucus is sometimes thin and glairy, and not easily recognized in the evacuations. Bloody evacuations are more frequent in chronic dysentery

[1 Op. citat., p. 302.]

than in Diarrhœa, but occasionally in these last, with ulceration of the follicles or membranes, blood may be present. In these cases it would be difficult to decide as to the source. In chronic Diarrhœa the quantity is generally much less than in chronic dysentery; in both, however, it may be in mere striæ or minute clots, or diffused in the fluids, and not recognizable except with the microscope.

In England, when the motions contain much mucus, and there are colicky pains, we may conclude that the flux depends upon irritation, congestion, or inflammation of the mucous membrane or follicles.

It is well to remember the possibility of both acute and chronic Diarrhœas being caused by irritant poisons administered either accidentally or purposely.

Prognosis is favorable in the feculent and in the irritative forms not dependent on matters poured in from abscesses, &c. Moderately favorable in the earlier stages of congestive and subacute inflammatory Diarrhœas in adults. Unfavorable in chronic Diarrhœas, and especially so when debility or anæmia or emaciation have begun. Very unfavorable when complicated with disease of liver or spleen, when there is much leucocythæmia, emaciation, scurvy, anasarca, or dropsy. The same may be said of lienteric cases. All these states are still more to be dreaded when circumstances render a change of climate impossible for tropical sufferers. In the last stages of chronic Diarrhœa it often happens that the motions diminish or cease for a few days before death. We should be careful not to give a favorable prognosis in these cases. The cessation is a sign of fatal debility.

Treatment.—As Diarrhœa may depend on so many causes, it is highly necessary before treating any particular case to ascertain as far as possible its nature and cause. In many cases it may be desirable to favor, or certainly not to check the fluxes, especially when, as in vicarious or other discharges, they eliminate noxious matters from the blood. In some of the irritative forms of Diarrhœa it may be desirable to assist nature in the expulsion of the offending cause; but in no instance should we consider that the removal of this supposed offending matter is the one and only thing to be aimed at. The general condition of the patient is also to be taken into account, and the effect which the purging may have had upon his system. It may be that the flux has so depressed the powers of life that they must be supported, and that the offending cause must be allowed to take its own course. The determination of this is a matter for pure experience, and must be left to the skill of the practitioner, and to his power of deciding between real and apparent debility. It would be well that no preconceived notions should guide us. In entering upon the treatment of any individual case we should always direct our attention to its particular cause, and consider the food, the water, the cooking, the cooking vessels, the season, and prevailing epidemic influences. In many cases the simple regulation or change of diet will render medicines unnecessary; or the removal of patients from districts in which the water or air is impure, or the supplying them with good and sufficient food and water, will be all that is required. In these cases it will generally be found that more than one person is affected; but this will not always be so, and the affected person may be a new comer, and not able to tolerate influences which have no effect on those habituated to them.

The common *feculent Diarrhœa* generally speedily cures itself by the ejection of the acrid or offending matters, and after four or five motions the patient is relieved and pain ceases. In these cases the patient may be left to himself. In places where no cholera prevails we may, if there be much colic, give a drachm of Gregory's powder (compound rhubarb powder), and a scruple of carbonate of soda, with ten or twenty minims of laudanum, in peppermint or plain water. The laudanum quiets the spasm and assists the action of the aperient. If the looseness continues after this has operated, preparations of chalk and soda, with or without opium, may be given every four or six hours. At bedtime a grain each of opium, calomel, and ipecacuanha may be prescribed for two or three nights. The diet should be light and small in quantity; for the first day little or nothing. The continued administration of aperients in Diarrhœa when the stools become pale or contain mucus is hurtful. When administered in persistent Diarrhœa they should be given rarely. When necessary, the patient may take a grain each of opium, ipecacuanha, and blue pill, at bedtime, and a mild dose of castor-oil in aromatic water in the morning. When the oil has produced two or three stools, the astringent remedies should be resumed. The patient is often debilitated even by such a mild course of purgation as this, and when such is observed, aperients should be avoided. If cholera prevails, opiates should invariably be used without aperients or without regard to supposed offending causes. In the more severe forms of flux, dependent upon diseased or putrid food, &c., the bowels should be evacuated if the strength permits, or if we think that the irritating and depressing substances have not already been voided; but in severe cases we must resort at once to stimulants, aro-

matics, ammonia, &c., warmth to the extremities, and bags with hot bran to the abdomen. Ether with a little laudanum, and warm brandy-and-water are often required.

In *summer Diarrhœa*, if the attack approaches choleraic Diarrhœa or cholera itself in character, the means mentioned in the article on cholera should be used—brandy, laudanum, camphor, sinapisms, and the recumbent posture, &c.

In Diarrhœas due to *congestion and inflammation* we should use warm fomentations to the abdomen, counter-irritants or rubefacients, as turpentine epithems and sinapisms, or even blisters, warm baths, with attention to diet and clothing. For internal medicines, Dover's powder with gray powder and soda, Dover's powder with bismuth and soda. Occasional purgatives may be required for this purpose; castor oil in emulsion with a few drops of laudanum will be the best. A dose of blue pill and ipecacuanha may be given at bedtime of the evening before the oil is to be taken. Astringents seldom or never act satisfactorily in the early stages of these forms. Counter-irritation, attention to the secretion of the skin and liver, with opiates and light digestible diet, are most useful. In the later stages astringents may be used with advantage. When entozoa are suspected, vermicide medicines with aperients may be tried.

In the *chronic forms* of Diarrhœa of all kinds the treatment is often very unsatisfactory. They often resist all remedies however carefully or judiciously they may be prescribed. This disease requires the full co-operation of the patient in all its stages. No special treatment is required for any particular form, so that the following observations, which chiefly apply to the white fluxes, will answer for analogous stages of any of the chronic forms. It is desirable that the diarrhœal drain should be stopped or reduced, but this will not be done by astringents only, without the improvement of the general health. We should endeavor to restore the function of the liver and skin, if impaired. We may assist the action of the liver by ipecacuanha, taraxacum, and nitric and muriatic acids. We must not suppose that these will be useful unless the patient's general health improves. We cannot expect the liver to furnish much biliary matter under special stimulants in the anæmic conditions of patients in the advanced stages of Diarrhœa. When the health mends, the secretions will improve also. The remedies mentioned above will not injure even under prolonged use, but mercury should not be given in these cases. Sir R. Martin has found nitric and muriatic acid used internally and externally very efficacious in these cases, and they should be tried. I suspect that these remedies are more useful in Diarrhœas with enlarged livers than where there is anæmia and deficient bile secretion without organic change in the liver. Twining recommended laudanum and nitric acid, and gave a case of rapid cure thereby. It may be given in doses of 10 to 15 minims of dilute nitric acid, and 15 to 20 minims of laudanum in calumba or gentian infusion or plain water, three times a day. In the anæmic stages I have sometimes seen benefit from 5 to 10-grain doses of the potassio-tartrate of iron, with 10 to 20 of laudanum in cinnamon water three times a day; also from the simple tincture of the muriate of iron. The iron alum is also a good preparation in 3 to 5-grain doses. Preparations of strychnine, with iron and opium, or the extract of nux vomica, or the powder of the seed, should always be tried; they appear to impart tone to the stomach and bowels, and are very valuable in some cases.

It would be well to use quinine in all cases in which malaria may be supposed to be operative. 5 to 10 grains may be given daily in divided doses, with an excess of sulphuric acid and with laudanum. If this irritates the bowels, it might be tried in the form of pill with opium, or in enemata with laudanum. Dr. Aitken mentions that salicine in 5-grain doses three times a day has been found very valuable in bad cases with a clean tongue, in which opiates and astringents had entirely failed. Bitter tonic medicines sometimes assist the digestion and improve the appetite, and opportunities should be taken of administering them in cases in which the stomach will bear them; they should be such as can be combined with the other remedies, such as iron, strychnine, opium, &c. The natives of India have for a long time used the Bael fruit in prolonged Diarrhœa. It seems to give tone to the bowels and to regulate them. In India, when the fresh fruit can be obtained, the natives roast it slightly and eat the inside pulp; one or two fruits daily. The Europeans generally use it in the form of a sherbet of creamy consistence, which may be made by scooping out the inside of the ripe or partially ripe fruit, mixing it with a little water to the consistence of pap, and removing all the stringy parts with a fork. A small tumblerful of this mixed with sugar is generally taken in the morning before breakfast. I have sometimes seen benefit from its use, but have been frequently much disappointed in its effects. Dr. A. Grant mentions that he has often found it fail in the treatment of the Hill Diarrhœa. Bael disagrees when the digestion is feeble, producing flatulency and acidity, and spoiling the appetite. In such cases it might be well to take it at bedtime instead

of in the morning. In Calcutta two or three preparations of the fruit are kept at the druggists', and may be used when the fresh fruit cannot be obtained. Some are also procurable in England.

In the treatment of Hill Diarrhœa, Dr. Grant observes that early and prompt cures follow treatment in the early stages. The great object is to restore the function of the liver and skin. This may be effected by at first giving a dose of blue pill and Dover's powder at bedtime, and castor oil with a little laudanum in the morning; repeating the remedies if necessary, and keeping up an astringent action on the bowels by occasional doses of hydrargyrum cum cretâ and Dover's powder, or by the compound powder of chalk, with one-fourth or one-half of a grain of morphia. He advises that opium should not be given except with ipecacuanha. In obstinate cases he trusts almost entirely to a combination of aromatics and astringents, concurrent with a strict attention to diet and clothing. He strongly objects to the use of mercury in the chronic stages, and urges change of climate. He has found benefit from the use of bromide of potassium in cases in which he has suspected the enlargement of the mesenteric glands.

It may be well to say a few words about the use of opiates and astringents, remedies which are so much used in Diarrhœa. Both are very valuable, but require discrimination in their use. *Opium.*—This is used largely by the natives of India for Diarrhœa, and many confirmed opium-eaters have acquired the habit by taking the drug for alvine fluxes. I confess that I have not seen it attended with the evils which some writers have. I think that the bad effect upon the secretions is much exaggerated. In health the hepatic secretion is certainly temporarily diminished or suspended by its use; but is this always its effect in disease? After much observation during the use of opium I think that it is not. But at any rate it does not injuriously influence the liver secretion when combined with ipecacuanha. On the skin the combination acts freely. Opium seems to act less as an astringent than as a sedative to the peristaltic action of the intestines, and retards the onward passage of their contents, and thus permits of more absorption, if the lacteals and veins are in a condition to profit by it. When there is degeneration of the villi, or disease of the mesenteric glands, this will be of no avail as far as the particular diseased tissues are concerned; but the degeneration may not be general, and the retardation of the mass within reach of efficient absorbents may be so far beneficial. Again, digestion in the stomach is often stopped by too rapid contraction of that organ, and hence the intestines receive irritating food. In these cases a grain of opium given with each meal instead of in prescriptions may assist in keeping it within the stomach, and favor its chymification. Opium may be hurtful in cases in which by observation the liver secretion is seen to be diminished under its use, or in those in which it checks the action of the bowels, retains the evacuations long enough to permit their partial decomposition, and thus increases colic and flatulence; but, as a general rule, it will be found that two or three grains of opium, or even more, given daily, combined with ipecacuanha, or even without it, will not be hurtful. Most of the preparations of opium or morphia may be used. *Astringents.*—These are often very inefficient and sometimes add to the discomfort of the patient by causing flatulence. Nevertheless they should be tried. If there be acidity, the preparations of chalk should be prescribed. The less in bulk the better. Bismuth, soda and morphia, form a very useful combination. Nitrate of silver, the sulphates of iron, copper and zinc, with or without opium, sometimes answer; as do tannin, gallic acid, simaruba, kino, alum, the mineral acids, &c., which may be tried successfully. One grain of tannin given every one or two hours has sometimes been beneficial, when the usual doses three or four times a day have failed. [An excellent preparation, when astringents seem to be needed to check an excessive flux, is a combination, in equal parts, of tincture of catechu and paregoric; of which half a teaspoonful or more may be given at a dose, every two, three, or four hours, so long as required. Acetate of lead is safe and useful in obstinate cases, in half grain or grain doses. It may be given in mucilage with acetate of morphia. Subnitrate of bismuth is hardly an astringent; it is rather an absorbent and emollient. Dr. Woodward[1] expresses the opinion that it is usually given in too small doses; one or two drachms daily being needed for much effect. Its most beneficial action is seen in cases of painless but continued Diarrhœa. My own experience with it in United States hospital cases was, on the whole, rather disappointing. Sir W. Jenner prefers the carbonate of bismuth in the Diarrhœa (when excessive) of typhoid fever.

A comparatively new remedy for Diarrhœa, much lauded by some who have used it, is the coto bark of South America. Dr. J. Burney Yeo recommends its fluid

[1 Op. citat., p. 790. Dr. Woodward asserts that the only danger of any poisonous action of large doses of subnitrate of bismuth results from its occasional contamination with arsenic.—H].

extract, in doses of 5 to 8 minims, for the control of exhausting Diarrhœa.—H.]

In some cases when the Diarrhœa is checked, anasarca and ascites will be found to increase. It is not often, however, that we find that the flux will be stopped in such stages; but if it should happen, it would be well to encourage the action of the skin by sudorifics, and that of the kidneys by diuretics, and if these fail, astringent medicines should be reduced or temporarily withheld.

Chalk or other mixtures should never be made up with sugar and mucilage in the hot and rainy seasons of India, or they should be made up for the day only. In less than twenty-four hours the mixture runs into complete fermentation, and is hurtful in Diarrhœa. The chalk mixture of the London Pharmacopœia is always useless in India. It is better to order mixtures prescribed for the occasion, containing ten grains of chalk to each dose, to be sweetened if desired at the time of taking.

Diet.—This demands the greatest attention in all states of Diarrhœa. In the chronic states what is called low diet is not suitable. The more nutritious the food and the more that can be taken without aggravating the flux, the better; we are limited, however, to diet which shall be digestible by the feeble stomach, and which shall not irritate the canal through which it passes, and this compels us to attend both to quality and quantity. In the mild cases of feculent Diarrhœa, simple abstinence, or farinaceous food for a day or two, will be necessary. This affection is sometimes kept up by too much food. In the protracted forms of Diarrhœa the dieting is not such a simple matter. It is in these cases of primary importance that it should be thoroughly digested before passing through the pylorus. In order to know whether the food which is taken is digested, the evacuations should be inspected frequently, after washing the matters if they are pultaceous, and by scrutinizing the sediment when they are liquid. These examinations show what food has been assimilated and what not. All such kinds as have not been properly reduced should be avoided. It is sometimes better not to give the food in a too liquid state. Some people who have Diarrhœa find this lessened or stopped when they leave off drinking much tea or water. Beef and pork and all tough parts of meat should be avoided. Mutton, veal, chicken, pigeon and game will frequently be borne. They should not be overdone in cooking, but this is of less consequence if they are gently stewed. Eggs in a raw or half-boiled state are good. Milk is often an excellent food, but not so if the casein is found unchanged in the stools. Milk combined with lime-water or with farinaceous food or broth should be freely given if found to agree, and then it is most valuable. Many kinds of food which do not digest if given in large quantity, often answer very well if given in small amounts. Starchy foods, such as arrowroot and sago, often produce flatulence, and do not suffice for prolonged nutrition unless combined with milk. Rice should always be old and given immediately after dressing. When mixed with milk it sometimes answers well, but at times disagrees. It is the food of many millions of people, and who often crave for it, but care should be taken that it is old and well cooked.

In Indian hospitals the wheat-eaters should be provided with the best kinds of fresh-ground flour free from bran. Soojee or the internal part of the wheat grain should be given if possible, and when well cooked and mixed with milk is nutritious.

It is not a good plan to restrict patients to farinaceous food; those who are accustomed to animal diet should be allowed it if they can digest it. I have known the inner part of a mutton chop cause less irritation than a basin of arrowroot. When it cannot be taken in the solid form, animal food may be borne in the shape of strong soups, chicken boiled with rice, as in the Indian "pish pash," or made into tender stews. In some cases of Diarrhœa in young children raw meat acts very favorably. In one instance known to me, though it cured the patient, tapeworm apparently resulted. Occasionally good pepsine given with the food seems to assist digestion, and should be tried, especially, in the lienteric cases.

Wine and stimulants may be given, as required, both in acute and chronic Diarrhœas. Good port wine and brandy-and-water are perhaps the best for chronic cases. Acid wines and beer seldom suit the patient.

In young children attention to diet is of the greatest moment; a change of wet-nurse is often enough to cure troublesome Diarrhœa in an infant, and change from hand-feeding to breast-milk equally useful. It is sometimes necessary to effect the change slowly and carefully; an infant allowed to take its full will often take more than it can digest, and its Diarrhœa be increased. When a good nurse cannot be had, or the child is too old, donkey's milk may be given, or a goat should be kept, and, in warm climates, milked just before using the milk. Goat's milk generally requires to be mixed with one-third water.

For fear of increasing the irritation of the bowels, fruit and vegetables are often entirely excluded from the diet of diarrhœal patients. Such a course, if they are not already scorbutic, is likely to render them so. I have seen such effects.

Fresh vegetables thoroughly and properly cooked, and soft fruits in moderation, should be allowed. Mealy potatoes, thoroughly ground down or mashed, are not hurtful, but unbroken lumps often entirely escape digestion, and cause irritation. If there be signs of scurvy, lime-juice syrup, pulp of grapes, ripe orange juice, or other antiscorbutic diet, should be cautiously tried.

It may be well to remark that the best of medical treatment of Diarrhœa may be rendered useless by bad cooking of the food. This is particularly the case in hospitals, especially in India, where the surgeon should consider the cooking very worthy of his attention.

Residence and Clothing.—Diarrhœal patients should remove from low and damp situations, and from dwellings subjecting them to malarious or vitiated atmospheres, to places in dry and open situations. They should be particularly careful of their clothing, and guard against sudden alterations of temperature. Flannel next the skin and flannel waist belts should be worn,

Change of Climate.—Change of climate for chronic Diarrhœa has long been understood and appreciated in India. I doubt not that it would be very beneficial in Europe also. In India there should be no hesitation in recommending this course, especially in the cases of white flux when the nutrition and strength begin to fail. Delay until emaciation and anæmia come on is very dangerous, as the chances of recovery are much reduced. Early and thorough change is more urgently required in old than in new residents. Should a patient after a month or six weeks find remedies unavailing, and that he is getting thinner without other cause than Diarrhœa, he should take change of air. The European may move away to some distant station in India, and the native of Bengal should go to the Upper Provinces, all seeking the places most free from malaria. The Hill stations are to be avoided. Patients near the coast should get to sea, which may be easily done, owing to the many coasting and other steamers plying in the Indian seas. These changes within the Indian limits may suffice for recovery if carried out in the early periods of the disease; but for old Indians and for those who have been long ill, a change to Europe is imperatively demanded. The practitioner in India cannot too well understand that if this disease is not stopped it is generally progressive, although perhaps from day to day there is little perceptible change, and that the sufferer should not wait until the pearly conjunctiva, the general anæmia, the emaciated form, and the darkened skin warn those about him how firmly the disease has established itself. Nothing is more painful than to see an anæmic, anasarcous, feeble, diarrhœal patient being "sent home," as it is called. The sufferings on board ship for these helpless people can be well imagined. When undertaking a voyage, care should be taken that suitable provision and nursing should be provided; but this, though possible for people in good circumstances, is often impossible for poorer persons. There can be little doubt that being sent to sea without comforts in an advanced stage of disease is an aggravation of their condition, and that they should be spared this by judicious early travel. It is to be hoped that the time will come when all ocean passenger steamers will specially provide for the comfort and care of sick passengers. Cabins with extra attendance and good sick cookery would be a great boon for the helpless invalid from Diarrhœa and dysentery, and for this a moderate extra charge would cheerfully be paid.

Mere change to England is not all that is required. When there, there must be a continuance of the same principles of treatment, the same attention to diet, to dwelling and residence, and even more attention to clothing and providing against cold or chills.

Convalescence.—All chronic Diarrhœas show tendencies to relapse, and therefore there must be for a long time avoidance of exciting causes in all patients, especially in articles of diet, and many months should pass away before the patient may return with impunity to his previous conditions of living. This is particularly to be attended to as regards return from Europe to India. A severe chronic Diarrhœa in old Indian residents demands two or three years' absence from India for safety on return, even although convalescence should have been restored soon after arrival in Europe.

[CHOLERA MORBUS.

By Henry Hartshorne, M.D.

Synonyms.—Cholera Biliosa; Sporadic Cholera; Cholera Nostras; European Cholera; *Fr.*, Trousse-Galant.

Most writers follow Celsus in deriving the term Cholera from χολή, bile, and ῥέω, to flow; but Hesychius,[1] Alexander of Tralles,[2] and Ruisch[3] have agreed in referring it to χολέρα, a roof-gutter for rain.[4] Sydenham's description of the disease is the classical one in modern medical history.

Symptoms.—Usually, nausea and general distress exist for at least an hour or two, sometimes for a day or more, before the attack becomes developed. Then vomiting occurs; first of the food last taken, with gastric mucus, and a little bile; afterwards of bile and thin mucus alone. At the same time purging begins, and is usually copious and frequent. The discharges from the bowels are, commonly, at an early stage, normal in color, but soft and semi-fluid, and with an offensive odor. Later, they may, in a protracted case, become watery and almost odorless. Only in rare instances do they lose all color, so as to resemble the stools of epidemic cholera.

Pain in the abdomen is often, though not always, present; each act of vomiting or purging giving temporary relief. The skin is natural or even warm at first, but before long grows cool and relaxed. Bad cases may be attended by a shrunken and clammy state of the integument all over the body. Such cases, also, may exhibit cramps, especially of the lower limbs; but these are absent in a majority of instances of the disorder. The pulse is normal at first, very rarely febrile; it grows weaker after vomiting and diarrhœa have fully set in. If the disorder continues unrelieved for several hours, the pulse becomes small, thready, irregular, and rapid; with other symptoms of collapse. The brain is unaffected; clearness of mind is usual (in the absence of complications) even to the end, in the worst cases. Great thirst and desire for cold drinks almost always exist. Either recovery or a condition threatening fatal exhaustion may be expected within twenty-four hours.

Diagnosis.—Idiopathic Cholera Morbus requires to be distinguished from the emeto-catharsis produced by irritant poisons (as the metallic salts, poisonous fungi, &c.); and also from epidemic or malignant cholera.

Irritant poisoning often, in its effects, very closely approaches Cholera Morbus. Symptoms important in discriminating between the two are: burning sensations in the throat and stomach before, as well as after, vomiting has commenced, when irritating substances have been swallowed; more intense gastric distress and abdominal pain, also, in the latter case; and the occurrence, in some instances of poisoning, of abdominal tenderness and bloody discharges; which latter, at least, are never met with in uncomplicated Cholera Morbus.

From Asiatic or epidemic cholera, the most nearly constant distinction is, the presence, in Cholera Morbus, of bile in the matters vomited, and fecal color and odor in the stools. Nausea and gastric pain are more marked in Cholera Morbus; cramps in the limbs, oppressed breathing, coldness and blueness of the skin, with a shrunken condition of the surface (washerwoman's fingers) in epidemic cholera. The latter disease, moreover, is in a great many cases preceded for a time, often for several hours, by diarrhœa. This is not at all usual with Cholera Morbus.

Concomitant circumstances may aid in this diagnosis. A case occurring in the winter, in a person whose diet has been simple and regular, should lead more readily to a suspicion of poisoning, than one in the summer or autumn. The presence or absence, in the same locality or vicinity, of cases of epidemic cholera, is of course an important consideration in regard to the probable nature of an attack.

Prognosis.—In persons of previously good health, Cholera Morbus, when properly treated, is rarely fatal; notwithstanding the great degree of prostration which it brings on. If, however, the pa-

[1 Probably in the 4th century.]
[2 6th century.]
[3 17th century.]
[4 Analogous in derivation to *diabetes*, from διαβήτης, a siphon.]

tient continues to vomit frequently after several hours, and the discharges from the bowels become more and more abundant, thin and colorless, with cramps in the extremities, cold surface, and thready, rapid pulse, the prospect is alarming. Instances are reported in which death has resulted within twelve hours; more often, however, later; sometimes after two or three days.

Morbid Anatomy.—I have never seen a fatal case of Cholera Morbus. Dr. G. B. Wood[1] states that "sometimes redness or other evidence of inflammation is discovered in the stomach, or some portion of the bowels; but often no such phenomena are presented, and neither the alimentary mucous membrane, nor any other structure, exhibits appearances which could explain the symptoms."

Causation.—Predisposition, at least, to this affection, is clearly connected with summer heat. It is said to be common in the tropics, even in places where epidemic Cholera is absent; and the large majority of cases in the United States occur in the months of June, July, August, and September, especially in July and August. Yet a sudden change of temperature, from exposure to a chilling atmosphere, when the system has been relaxed by continued heat, may be observed to act in producing the attack in many instances. Getting the feet wet; being out in a shower at the close of a hot day; or going from a warm kitchen to a cold springhouse; these exemplify this kind of exciting causation.

Yet a still greater number of cases may be traced to the use of indigestible food. Unripe fruit, or excess in eating that which is ripe; raw turnips, or undercooked new potatoes, beans, cucumbers, &c.; too young veal; fish, lobsters, or crabs, too long from the water before being cooked; sour cider, beer, or wine: all these may produce Cholera Morbus in persons predisposed to it. The same result may follow copious draughts of ice-cold water, taken when exhausted by heat and fatigue.

Malaria is credited with the causation of some attacks. Undoubtedly nausea, and, occasionally, vomiting, may be *prodromata* of intermittent or remittent fever. Such vomiting and purging as thus occur, will be likely, although possibly violent, to be brief in duration.

Sudden and powerful mental impressions are said to have, in a few instances, brought on Cholera Morbus.

Treatment.—Gastric, hepatic, and intestinal irritation, with increase of all the secretions of the stomach, liver, and bowels; also spasmodic ejection of the contents of the stomach, and exaggerated enteric peristaltic movement: such are the *indicating* facts of Cholera Morbus. Especially when indigestible food is the provocative cause, *acidity* of the contents of the stomach and small intestine increases the irritation. An acrid character of the bile, as well as an excess of its discharge into the duodenum, is also reasonably supposed to exist.

In accordance with these conditions, medication adapted to the neutralization of acid results of indigestion, and of the resinoid acids of the bile, might be expected to do good. Thus we may account for the benefit constantly obtained from a mode of treatment proposed and employed for many years by the late Dr. Joseph Hartshorne. This was, the administration, from the beginning of the attack, of a teaspoonful every twenty minutes of the following mixture:—

℞ Sp. ammon. aromat. f℥j
Magnes. optim. ℥j
Aquæ memthæ piperitæ, f℥iv.
To be shaken when taken.

I have seldom found this to fail to give relief in an hour or two, when it has been commenced with early. At the same time, however, a large sinapism ought to be placed over the epigastrium. Ice may be given in small pieces to quench thirst. Should the case be seen rather late, when the diarrhœa has been already very copious, sodium bicarbonate may be substituted for the magnesia; and a dessertspoonful or two of paregoric may be added to the mixture. At a late stage, also, advantage may accrue from the use of gastric stimulants; such as tincture of ginger, or strong infusion of cinnamon or cloves.

Should coldness of the surface be marked, hot bottles, bricks, or bags of salt should be applied to the back and limbs. An obstinate continuance of the diarrhœa will afford indication for the use of an enema of laudanum and starch; or persistent vomiting may call for a hypodermic injection of morphia. Stimulation with brandy or whiskey will be required in cases of threatening prostration. Best, in such cases, will be the addition of alcohol in moderate amounts to arrowroot or boiled or scalded milk; to which, also, limewater may be added with advantage. The quantity of everything given by the mouth in Cholera Morbus must always be small. Care of the diet will be necessary for several days during recovery. At this time a very suitable article of food will be chicken broth, from which all the fat has been carefully removed.

As an external application, when nausea and vomiting continue after a mus-

[1 Practice of Medicine, vol. i. p. 649.]

tard plaster has been left on sufficiently long, a spice poultice may be applied.

A more common plan of treatment than the above consists in the administration of small doses of calomel and opium, in pill; say half a grain of calomel, with a quarter or half of a grain of opium, every two hours. No objection can be brought against this practice, which is favored by many physicians of experience. My success, however, with the method of medication above mentioned, has been such as to warrant its recommendation in common Sporadic Cholera Morbus. It will be entirely out of place and useless in the treatment of epidemic Cholera.]

[CHOLERA INFANTUM.

By Henry Hartshorne, M.D.

Synonyms.—Summer Complaint; Follicular Enteritis of Infants; Sporadic Infantile Cholera; Choleric Fever of Infants; Gastro-enteric Catarrh; *Mal d'Été.*

If there be any disease which can be said to be characteristically American, it is this. Yet to some extent also its existence in European cities is evident, from descriptions in the writings of a number of authors; as Trousseau, Rilliet and Barthez, Billard, and Barrier in France; Niemeyer, in Germany; Weisse, in Russia; Copland and West, in England.

Until within comparatively a few years, American writers have classed together all cases of what is popularly known as *summer complaint* in children, under the name Cholera Infantum. Latterly, Meigs and Pepper[1] and others have urged the propriety of separating, in diagnosis and nomenclature, this affection, as a true choleraic disease, from the entero-colitis of infancy, acute or chronic. There is no doubt that many instances of intestinal inflammation occur in children, at all seasons and under many circumstances, to which there is no reason for giving the name of Cholera Infantum. Rilliet and Barthez even assert that, under their observation, of every two young children that die, one exhibits a more or less serious lesion of the large intestine. But there does not seem to be sufficient ground for the narrowness of limitation now mentioned for the term Cholera Infantum. As described by the authors referred to, entero-colitis occurs, in most cases, under the same combination of promoting and exciting causes, with the same commencing and closing symptoms, and with the same lesions (differing only in degree, not in kind) as what those authors recognize as Cholera Infantum.

Objection appears to be made to the application of this latter designation to cases not attended throughout their duration by violent vomiting, and prostration resembling the collapse of epidemic cholera. But the term cholera, being as old as the time of Hippocrates, had the meaning of *copious watery flux*, long before epidemic cholera had any place in nosological literature. This kind of disorder, then, may well be called choleraic; and, in view of the essential agreement of a large number of cases, in etiology, general semeiology and morbid anatomy, we may safely call by the name of Cholera Infantum all such attacks as have the following characteristics: affecting infants during their first or second year, especially at the time of dentition; occurring in towns, or populous rural localities, in hot weather; attended by vomiting during a portion, but not necessarily the whole, of their course; with diarrhœa, acute or chronic, usually producing emaciation, and threatening, if not fatal debility.

Symptoms.—Most generally, *diarrhœa* is the primary disorder. It is always to be remembered that, during the time of teething, a *free* condition of the bowels is desirable and important. The reflex excitation of the nerve-centres of the organic system, connected with the formative *nisus* in the mouth, finds its safest relief in excito-secretory[1] discharges from the intestines. Three or four movements of the bowels, moderate in amount, will never be too much, especially during warm weather. More than that number, or even but two or three excessively thin

[1 Practical Treatise on Diseases of Children, Philadelphia. Fourth Edition, 1870, *et seq.*]

[1 Campbell, of Georgia, and Longet, have established the fitness of this term.]

and copious discharges, will justly require attention from the physician.

Vomiting is, in some instances, an initial symptom; much more often, it follows diarrhœa after a few days; or, sometimes, weeks.

Fever exists in a minority of those cases which develop themselves gradually from diarrhœa. In the most sudden and acute cases it attends the early stage, not unfrequently. Its duration is seldom greater than three or four days; and some of the worst and most rapid cases are entirely without it.

Emaciation commences soon, and increases often with wonderful rapidity. One or two days may suffice to change a round, plump, rosy infant into a pale, thin, haggard-looking sufferer, with sunken eyes, hollow cheeks, and mouth drawn down at the angles; the body being wasted, and the skin much relaxed.

Prostration attends this condition, the child not inclining to sit up, often not to lift or even turn its head; lying, in many cases, at a late stage, in a state of apathy.

Restlessness however, in many severe cases, is a prominent symptom, especially in the early stage; crying often, at first, though not vigorously; afterwards moaning feebly,—or merely rolling from side to side or tossing the hands about. When debility has advanced far, rolling of the eyeballs may be seen to occur, with a grinding motion of the jaws, even during sleep.

Nervous symptoms of a serious character, as stupor and convulsions, are not uncommon in bad cases. Evidence of delirium is rarely met with in young children; but loss of sensibility (the child not "taking notice" of anything offered to its sight, hearing, or touch) is far from rare.

The *pulse* is almost always accelerated in this disease; at first, in some instances, with febrile excitation; later, in all except those of the briefest duration, from prostration.

The *abdomen* is described by authors as often tumescent, even tympanitic. Under my observation, this has almost never occurred. It is quite possible for the hand and eye to be deceived by the muscular resistance provoked by the child's fear of inspection and palpation. If its attention can be at the time diverted away from its own body, the apparent tumidity will not unfrequently pass away under the hand. Still, I do not doubt that actual tympanites does exist in a certain proportion of cases; while many others exhibit, as the disorder advances, a positive in-shrinking of the abdominal walls.

Thirst is intense, usually, from first to last, while the severity of the attack continues. Water is taken with avidity, even when at once rejected by the stomach.

Urination is apt to be scanty, in a quite marked degree, throughout the attack. Toward the end, in some fatal cases, there is reason to believe that deficient action of the kidneys, inducing uræmia, hastens death.

Our attention may, with advantage, be given more in detail to some of these symptoms.

The movements of the bowels vary much in frequency, as well as in quantity and character. Sometimes there are but four, five, or six in the day and night; and yet, if copious, they may exhaust the system: especially when, as is usual, very little food can be taken, or, if swallowed, digested. Twelve, fifteen, twenty, even twenty-five passages in twenty-four hours occur in some instances.

In cases of gradual approach, the stools at first deviate little, except in greater fluidity, from those of health. Considerable odor then belongs to them; now and then, it is very offensive. When the attack is sudden, such characters appear but for a short time. In all cases, the discharges grow, as the disorder advances, more watery, less odorous, and more different from their normal appearance in every way. Principally composed of serum and mucus, a little bile may be present, with altered blood-constituents, and imperfectly digested materials of food, as casein, starch-corpuscles, milk-curds, &c. To such the term lientery applies. Actually bloody stools are not met with in Cholera Infantum. Often the color of the passages is greenish; or the fluid may be colorless, but containing numerous greenish masses or particles, which remain on the napkin after the watery portion has soaked through it. With the greenish color, there is apt to be a somewhat peculiar sour or mawkish odor; quite different from that of healthy feces, as well as from those of other acute febrile diseases. Great fluidity of the passages is an extremely common character.

The nature of the green stools has been the subject of some discussion. When calomel or other mercurials have been given, the investigations of Lehmann, supported by those of Merklein and others, show that they may be explained by the formation of sulphide of mercury in the intestines. Golding Bird,[1] however, concluded, after chemical inspection, that the green color is owing to the presence of altered blood. Since this coloration of the passages occurs in many cases in which no mercury has been administered, this latter account of the matter appears to me to be justified: while accepting also the view sustained by many observations, that the presence of biliary pigment frequently has an influence.

[1 London Med. Gazette, 1845, p. 801.]

Bamberger has shown[1] that the existence of an uncommon amount of bile in the passages from the bowels does not prove an increase of its secretion by the liver; since it may result from the prevention, by morbid conditions, of the normal resorption of bile from the intestinal canal.

The matters vomited are not peculiar to this disease. At first consisting chiefly of food or drink taken, they afterwards contain also gastric mucus, a little biliary matter, rejected medicines, &c. Occasionally they are greenish; but seldom so decidedly colored as are the stools. When milk is thrown up, it is commonly not coagulated; whereas in the vomiting of over-fed healthy infants, milk re-appears in clots, from the prompt action of the gastric secretion upon it.

The temperature of the body, in summer complaint, is mostly high, during at least the early stage. The head, especially, is apt then to be hot. So, also, is the abdomen. But when prostration comes on, which, in acute cases, may be very soon, coldness, resembling that of malignant cholera, may occur. Sometimes the feet and hands are cold, while the head and trunk are warmer than natural.

The pulse varies from 120 to 140 or more in the minute. Seldom does it present the characters which are commonly met with in active inflammatory disorders having fever as an accompaniment.

Respiration is sometimes embarrassed in bad cases; recalling the tendency to asphyxia in Asiatic cholera. But this symptom is, according to my observation, altogether absent in a large number of instances.

The state of the brain and nervous system, as shown by symptoms, is one either of irritation or of oppression.

The former prevails at the beginning of the attack, and the latter after its continuance for a time. Only in a few cases the signs of cerebral disorder predominate so decidedly, even from an early period, as to give occasion for doubt as to the diagnosis between Cholera Infantum and meningitis or "acute hydrocephalus."

MORBID ANATOMY.—This has been particularly investigated by Horner,[2] Hallowell,[3] Stewart,[4] and J. Lewis Smith,[5] in this country, and Rilliet and Barthez,[1] Legendre, and others abroad. There is, moreover, as Drs. Meigs[2] and Pepper have remarked, much instruction to be obtained from consideration of the analogy (or rather similarity) between the choleraic diarrhœa of infants and the camp diarrhœa of soldiers, so elaborately studied by Surgeon Woodward and other medical officers of the U. S. Army during the late war.

All observations show that the large intestine is the principal seat of such changes as occur in this affection. In 82 cases of entero-colitis of children, Dr. J. Lewis Smith found inflammation of the mucous membrane of the colon in all but one case; the ileum was involved in 49 cases, and the upper portions of the small intestine in but 12 cases. Either the whole of the colon may be affected, or the descending portion alone. Almost never is the upper part of the colon inflamed without participation of the sigmoid flexure and descending colon.

Yet the most intense signs of hyperæmia are in some instances found in the cæcum and sigmoid flexure.

Sometimes, in acute cases, a diffuse redness of the mucous membrane exists. More often it occurs in patches of various extent and localization; or it may be arborescent. Distension of some of the bloodvessels of the gut may be almost always observed on close inspection. The color may be of any degree, from the palest pink to a dark livid hue.

More or less general tumefaction of the hyperæmic portions of the intestine is met with, even in those dying at an early stage. Softening, also, begins soon in some cases; even erosion of the surface of the mucous coat; although ulceration proper belongs to subacute or chronic cases only.

Follicular alteration is the most nearly universal lesion in all grades of this disease. It affects the solitary follicles of both the large and small intestines in many cases; and, also in a considerable number, the patches of Peyer. Enlargement begins early in the solitary follicles. They are then whitish, roseate, or yellowish, like grains of the size of a pin's head, with a dark point of pigmentary deposit in the centre, at the excretory orifice of each gland. The agminated glands, under the same kind of change, present what is known as the *shaven beard* appearance, more or less marked.

Later, with farther enlargement of the follicles, their orifices are increased in size; sometimes becoming as much as a millimeter in diameter. Softening and

[1] Quoted by Woodward, op. citat., p. 275.]

[2] Am. Journal of Med. Sciences, Feb. 1829.]

[3] Am. Journal of Med. Sciences, July, 1847.]

[4] Prize Essay on Cholera Infantum; Trans. of N. Y. Academy of Medicine, 1856.]

[5] Treatise on Diseases of Infancy and Childhood, p. 367.]

[1] Traité des Maladies des Enfans, t. i. p. 692, &c.]

[2] Op. citat., p. 348.]

ulceration then follow; either involving the follicle and its base alone, or gradually extending, in prolonged chronic cases, into a wider region of the mucous and submucous membranes. The ulcers are oval or circular, with edges from the first rather sharp, and afterwards undermined. When several combine, an irregular outline results; the intermediate portions of the mucous membrane being tumescent, and altered in color. Not unfrequently induration takes place instead of softening; or the former may occur in the *submucosa*, reaching also, by deposit of connective tissue, to the muscular, or even to the peritoneal coat; while at the same time the mucous surface undergoes softening.

The peritoneal coat of the intestine is affected in some, but not in nearly all cases; with increase of vascularity early, and sometimes also with extravasation of lymph, corresponding with the hyperæmic patches within the gut.

This exudation, however, is comparatively rare; and chronic cases, of slow progress, are less apt to be attended by peritoneal alteration of any kind. Pseudo-membranous deposit is occasionally, but not often, met with upon the hyperæmic follicles in acute, or upon the ulcerated portions in chronic cases.

That all these morbid changes are consequences of simple inflammation, is not at all certain. Billard, Andral, Trousseau, Lebert, and others have shown that hyperæmia of the intestinal mucous membranes may be found after death in persons who have had no symptoms of disorder of the bowels. Softening, also, may be a purely post-mortem change. It is only where the redness is arborescent, and is attended by extravasation of lymph, or the formation of pus, or at least of pyoid globules, with infiltration of the affected tissue, showing something more than mere vascular dilatation, that we can pronounce the case to have been of a distinctly inflammatory nature. Undoubtedly many cases of so-called chronic inflammation, of the bowels, as of other parts of the body, consist really in non-inflammatory hyperæmia or passive congestion; the result of vaso-motor paresis, and consequent relaxation and distension of the vessels, without exudation, although with altered secretion and increased epithelial desquamation. Further: the redness may in some instances be due to hemorrhage, or transudation of blood pigment, from partial dissolution of blood corpuscles within the mucous and submucous tissues of the intestine.

Upon the subject of the histology of diarrhœal entero-colitis (which, as above said, I identify, when it occurs in young children in summer, with Cholera Infantum) no better or more authoritative account can be obtained than that of Surgeon J. J. Woodward.[1]

"At a very early period of the inflammatory process an increased number of lymphoid elements will be found scattered through the submucous connective tissue. This will be noticed especially in the immediate vicinity of the muscle of Brücke, where these elements are most numerous in the normal condition, but it will be observed in all portions of the submucous tissue. It will frequently be observed in sections that the lymphoid elements occur in swarms around the peripheries of the small veins. They also appear in rows, and in more or less irregular stellate groups corresponding in outline to the serous canals of the connective tissue. These latter appearances were the foundation of the opinion formerly prevalent, that the new elements were produced by cell-multiplication from the connective tissue corpuscles; an opinion which the discovery of Cohnheim[2] compels us to modify, so far as to regard the new elements as consisting in part at least of white blood corpuscles which have migrated from the bloodvessels. Whether any cell-multiplication actually occurs is difficult to be seen in the intestine.

"The discovery of such an increase in the number of lymphoid elements in sections of the submucous connective tissue may be regarded as conclusive evidence that actual inflammation has existed during life, while the abnormal fulness of the bloodvessels alone may result from mechanical obstructions to the portal circulation, or may represent merely a condition of hyperæmia hardly amounting to inflammation. Besides the lymphoid swarm in the submucous connective tissue, this layer is generally infiltrated with an excess of plasma, by which the cohesion of the fibrillated matrix is loosened and the lymph-space increased in size. To this cause, together with the vascular congestion and the presence of the lymphoid swarm, is due the thickening of the submucous layer which is generally present. Sometimes also the large nucleated cells observed by Basch[3] and Thierfelder[4] in sections of the colon from cases of diphtheritic dysentery are found lying loose in the lymph-spaces, or adherent to their parietes. They are probably swollen and loosened endothelial elements, and are especially noticeable in diphtheritic cases, or in chronic cases accompanied by follicular ulceration.

"Simultaneously with the increase in

[1 Op. citat., p. 325.]

[2 Virchow's Archiv, Bd. xi. 1867, s. 1.]

[3 Virchow's Archiv, Bd. 45, 1869, s. 204, and Taf. 13.]

[4 Atlas der Path. Histol., 1873, Taf. xii. Fig. 5.]

the number of lymphoid elements in the submucous connective tissue, a similar increase takes place in the number of these elements in the adenoid tissue of the mucous membrane and of the closed follicles. . . . . No reasonable explanation has been suggested for the fact that the solitary follicles are more conspicuously enlarged than the agminated, the reverse of what usually occurs in typhoid fever.

"The behavior of the columnar epithelium on the surface of the intestine while the foregoing changes are taking place, remains involved in considerable obscurity. The intestinal epithelium separates from the mucous membrane, in consequence of cadaveric changes, at a very early period after death, even in the perfectly normal intestine. Perhaps this separation takes place at a still earlier period in inflamed intestines, as, indeed, all cadaveric changes appear to do. But the readiness with which even the normal intestinal epithelium separates after death excites doubt as to the proper interpretation of those observations which seem to indicate any very extensive desquamation of the intestinal epithelium during life as a result of the inflammatory process. Certainly the autopsies which furnished the material examined at the Museum, in connection with diarrhœa and dysentery, were generally made long enough after death to render it certain that the separation of the epithelium observed was merely a post-mortem phenomenon."

Outside of the intestinal canal, Cholera Infantum presents no constant or characteristic anatomical changes of any of the viscera. The mesenteric glands, it is true, are usually enlarged, especially in chronic cases, and sometimes more or less softened. Even the stomach is seldom found to have undergone any marked morbid alteration.

The liver might be expected to be prominently affected, on account of the disease occurring under the influence of a high temperature; but this anticipation has not been confirmed. Congestion of the liver has sometimes been met with; but not sufficiently often for it to be regarded as other than an accidental complication.

Nothing important has been met with in the spleen, lungs, or kidneys, in patients dying with this affection. The brain, also, is, in a majority of cases, found to be without lesion of any kind. Sometimes, in chronic, and also in rapidly exhausting acute cases, it shows signs of anæmia and commencing atrophy, with the general waste of the body. In a few instances, there is turgescence of the pia mater. Some authors report examples of central as well as peripheral vascular injection of the brain substance itself.[1]

Lastly, it must be said, that cases of fatal acute Cholera Infantum may occur, without any decided anatomical alteration being found, even in the intestinal canal. So far as the immediate symptoms are concerned, in such cases, the disorder appears to have been altogether functional.

ETIOLOGY.—The agencies manifest in the causation of Cholera Infantum are: 1. Hot weather. 2. Atmosphere of large cities or closely built towns or villages. 3. Unwholesome food. 4. Predisposition connected with dentition. Much the largest number of cases occur during the first eighteen months of life. More males die from this disease than females. The mortality from it in New York and Philadelphia, when the temperature is over 95° in the shade, has sometimes been frightful. It constitutes, in such weather, the largest item in the necrological records of those cities. For example, in the hottest week of July, 1872, there were in New York 1569 deaths; in the same week in Philadelphia, 746 deaths. Of the latter, 274 were reported as resulting from Cholera Infantum. 512 deaths in Philadelphia during that week, however, were of children under five years of age. The total mortality at all ages and from all causes, in the more healthy weeks of the year, in Philadelphia, is often not much over 300.

In 1876, the hottest week in July gave an aggregate of deaths from all causes in New York of 1298. This exceeds the average weekly mortality of London, whose population is between three and four times as great as that of New York. During the same week, in Philadelphia, there were 434 deaths of infants under two years of age.

The following Table shows a less extreme, but still large, number of deaths from intestinal disorders during infancy, in New York, for the third week of July, in ten years:—

Diarrhœal Diseases in New York.

	Deaths under 5 years of age.
1870	307
1871	235
1872	403
1873	418
1874	358
1875	379
1876	399
1877	285
1878	314
1879	268

In Philadelphia, notwithstanding considerable increase in the population, the

[1 C. E. Banks; Fiske Fund Prize Essay on Cholera Infantum, Providence, 1879, p. 16.]

number of deaths from Cholera Infantum for the year 1879 was actually less than in 1872. The number for 1879, moreover (700), was 269 less than in 1878; this decrease being, in part, at least, ascribable to improved sanitary aid and instruction afforded to poor families by benevolent persons and organizations.

The great influence of the vitiated atmosphere of large cities in producing Cholera Infantum is established by a two-fold proof: first, the rarity of the disease in rural localities in the same physical zone; secondly, the prompt improvement effected in children sick with it, when they are removed to an open, healthy country place. This influence is most marked, of course, in the worst parts of the city; where dirty streets, confined houses, and unclean living in every way, make the air foul and promotive of all "zymotic" diseases. But its effects are shown also in the better urban quarters, even amongst the spacious dwellings of the wealthy class. There is no *hygeoscope* (to coin a term) so sensitive as the constitution of a teething infant.

Indigestible food, however, has also an important share as an exciting cause. If mothers suckle their infants, their milk may be impaired in quality by circumstances unfavorable to their own health; the delicate child being more sensitive than its parent to all unsanitary causation.

If artificial feeding is depended upon, the case is worse. Cow's milk is mostly used. It is often brought in wagons or on railroad cars from a distance of many miles, and is no longer fresh when given to the child. An hour or two of time, in warm weather, may suffice to make a very critical difference in its qualities as food for an infant already suffering from heat and an unhealthy atmosphere. Further, many parents, especially among the ignorant poor, are imprudent enough to give to their infants, even under two years, meats, vegetables, unripe fruit, and pastry from their own tables. This, when they have no teeth for mastication, is ruinous to their digestive apparatus. A mistake once (if not still) common amongst people of better circumstances, is, to feed infants upon farinaceous materials (corn-starch, arrowroot, &c.), which, containing no nitrogen, unless made with milk, fail to afford substance for the building up and repair of their growing and wasting tissues. Probably, also, the advice formerly given by physicians, to dilute largely the cow's milk given to young infants, may have contributed to their inanition. An infant between six months and a year of age will, when in health, often consume three pints of milk in twenty-four hours. If two pints of this are water, the child's needs are certainly not supplied, and anæmia, debility, and predisposition to disease may follow.[1]

The *rôle* of dentition in the etiology of summer complaint, is that of a contributive or predisposing cause. Allusion has been made on a previous page to the reflex or sympathetic relation between the intestinal secretory apparatus and the mouth, evinced at the time of teething, under various circumstances. This is equally near, and more commonly and often safely manifested, than that relation with the spinal motor system, whose morbid influence is recognized in the "explosion" of infantile convulsions. At all events, nothing is more certain than the constant *coincidence* of the occurrence of Cholera Infantum with the process of dentition. While teething is, in itself, a normal physiological procedure, it involves an exceptionally localized formative *nisus*. The two factors in this, viz., the local determination of blood and innervation, and the relatively adjusted resistance and absorption of tissues, must be exactly balanced, for the period of dentition to be passed through without disturbance of health. Anything which intensifies nervous irritability on the one hand, or on the other renders absorption sluggish and imperfect, may induce, as a result of excessive tension, the excito-motor agitation of convulsions, or the excito-secretory disorder of diarrhœa. High heat and a bad atmosphere, especially when aided by unwholesomeness or insufficiency of diet, will readily exaggerate what otherwise might have been a merely salutary elimination into an exhausting disease.

PATHOLOGY.—This may be inferred, or at least with probability conjectured, from what has been said. The prominent features of the disorder are: 1, functional impairment of, and excessive transudation from, nearly the whole alimentary tract; 2, general malaise and debility; 3, a special tendency to nervous symptoms, *e. g.*, restlessness, apathy, and stupor, varying in different cases and in the successive stages of the disease.

Underlying these morbid conditions, there is reason to believe that the chief seats of diathetic modification in Cholera Infantum are, the blood, and the ganglionic nervous apparatus of organic life. The participation of the blood in morbid changes, at least its impoverishment, is to be inferred from the great impairment of digestive power, which makes anæmia or spanæmia a necessary result; and also from the resemblance of many of the

[1 Drs. Rogers, of New York, and Hiram Corson, of Pennsylvania, deserve credit for having especially called attention to this matter.]

symptoms to those produced by inanition. This comparison has been made especially in view of the observations of Chossat upon the latter subject.

Rilliet and Barthez, Sedgwick, H. Jeaffreson,[1] and Meigs and Pepper have given cogent reasons in favor of accepting the opinion that, in the pathology of this affection as well as in that of malignant cholera, derangement of the ganglionic nervous system ("sympathetic nerve" of anatomists) is of primary importance. Moreau and Asp are cited by the last-named authors as having ascertained by experiment that when section is made of the nervous branches distributed to the intestines, a copious flux of serous fluid takes place into the bowels.

Diagnosis.—This presents generally no difficulty. As remarked at the beginning of this article, there appears to be no necessity nor advantage in separating from Cholera Infantum those cases of entero-colitis of hot weather in infants under two years of age, which some authors lately discriminate from it. From meningitis, simple or tubercular, it needs sometimes to be diagnosticated, when brain symptoms are more than usually predominant in its course. But, in meningitis, the cerebral disorder is, from the first, strongly marked; in Cholera Infantum, although the head may be hot quite early, and restlessness may then be great, the tendency to insensibility or stupor does not appear often before exhaustion supervenes. In meningitis, the bowels are mostly constipated; if vomiting and diarrhœa exists, they are slight in comparison to the gastric and intestinal disturbance of Cholera Infantum. The season of the year, age of the patient, and the occurrence of the attack in a large city, will aid in making out the distinction; notwithstanding the fact that inflammation of the brain may take place at any age, season, or locality.

Prognosis.—The duration of attacks of Cholera Infantum is very variable. Cases are reported, imitating Asiatic cholera in violence, in which death has resulted within twenty-four hours. I have never seen such, and believe them to be rare. As the description of the disease is limited by Drs. Meigs and Pepper, so as to include only cases in which a "choleraic" collapse occurs, it may be said to end either in death or in recovery, within two, three, or four days. But a choleraic diarrhœa may precede such symptoms for an indefinite time, and a subacute or chronic diarrhœa may follow the subsidence of the more violent emetocatharsis, under treatment.

[1 Edin. Med. Journal, Dec. 1866, p. 520.]

Bad signs in Cholera Infantum are, extreme restlessness and jactitation, or, on the other hand, early apathy, stupor, or convulsions; incessant and irremediable vomiting; excessive frequency and copiousness of the discharges from the bowels; a pinched, "Hippocratic" countenance; and coldness, with a blue and shrunken appearance, of the extremities.

Of favorable omen are, cessation of vomiting, and diminution in the frequency and quantity of the discharges; quiet natural sleep; even temperature of the body and limbs; diminution of thirst, and a return of appetite and capacity for the digestion of food.

Treatment.—First of all, when practicable, we should advise that the child be taken away from town. Removal to an open healthy locality will often cure, without any medication whatever; and no treatment is certain to succeed while the patient is still confined to the city.

The air of the sea-shore will always agree with such cases. The only question there will be in regard to the child's food and water. If the water is sure to be neither brackish nor tainted with privy-poison, and (when the child is fed by hand) an abundant supply of good fresh milk can be relied upon, the sea-shore will be the best possible place. An infant at the breast may, as a rule, be taken thither without hesitation. When a mountain resort is more convenient, it may be expected to answer perfectly well. Indeed, any moderately elevated locality, quite out of town, with good milk and pure water supply, will be infinitely preferable to even the best part of a city, for a child at any stage of Cholera Infantum.

With poor children, whose parents cannot take or send them to the country, the next best thing is to have them carried every day to an open park or square, for as many hours as possible; or excursions upon the water, or by rail; so as to breathe unspoiled air as long and as often as practicable. No one who has seen how a languid, apathetic babe, shrunken and almost collapsed, will revive at the first breath of cool air from the hills or from the sea, can fail to recognize this as the great cardinal remedy (or better, prophylactic) in Cholera Infantum.

Diet is next in importance. No infant should, if it can be avoided, be weaned during the summer, in the climate of the United States. If, having been weaned, it becomes ill, a good breast should be sought for it. When this is not obtainable, we must make its food as little distressing as possible to its digestive organs. Cow's milk being its principal basis, to this may be added barley-water and lime-water; the first to dilute and render more assimilable the casein of the milk, and the

second to correct acidity, which is almost or quite always present. Equal parts of barley-water and *unskimmed*[1] milk may be given; one or two tablespoonfuls of lime-water being added to each tumblerful of the mixture; besides sugar and a little salt.

Freshness of the milk used is of the utmost consequence. It becomes, after a few hours, in warm weather, sufficiently changed to be unsuitable for a delicate infant's stomach, even before any perceptible souring or curdling takes place. Frequent and careful cleansing of the bottle used is also indispensable. When fresh cow's milk cannot be obtained, condensed milk may be used with advantage.

If debility increase, variation of the diet may be made by giving chicken-water (not too thin, but having the fat carefully removed); or, still later, beef-tea.[2] To the latter, an equal amount of barley-water may be added, if there seem to be any difficulty in its digestion. *Frozen* beef-tea (suggested by Dr. H. B. Hare, of Philadelphia) will often be very grateful and available; everything cold being more agreeable to the mouth of the sick child, and more acceptable to its stomach. Weak wine whey may be given, in feeble cases; or white of egg beaten up with barley-water, to which a few drops of brandy or whiskey have been added. Boiled flour suits some children very well.

Sometimes, when vomiting is very constant and obstinate, it will be best to withhold all food and drink for a number of hours. Even six, eight, or ten hours of fasting will often be borne well, and will allow the digestive apparatus to rest, as well as to rid itself of accumulated ingesta and secretions. Another point of some moment is not to load the infant's stomach with a disproportionate quantity of food requiring digestion, when what it really wants is water to quench thirst. As to the propriety of giving water freely in this complaint, authorities differ. Drs. Meigs and Pepper urge that the natural indication of thirst should be met fully, without hesitation on account of the frequent rejection of fluids when taken. Others, because of this irritability of the stomach, would withhold it almost altogether. It appears to me that an intermediate course is best. Do not give large draughts of water at once; but mitigate thirst by small quantities given with sufficient frequency. Ice is more grateful than water for such a use, and is composing to the irritated stomach. It may be pounded and put in a soft, clean rag, which the child may suck freely.

Attention to the state of the gums is, in this affection, imperative. If they be swollen and turgid with blood, or tense, with the crowns of teeth near the surface, and evidently causing nervous irritation, let them be lanced freely. The recent denunciation of this measure of treatment by some authors, is not justified by the experience of a multitude of practitioners. Of course, lancing must not be done roughly; the gums are not to be hacked or lacerated. When clean incisions are made, there is no danger whatever of cicatrices, or of any other inconvenience, unless, in very rare instances—excess of bleeding from *hæmophilia*. (See article on this subject in Vol. II.) Indiscriminate and needless lancing is to be avoided; but if there be a doubt, the safer error will be to lean towards doing it too often rather than too seldom, when either nervous or intestinal disorder is present.

Bathing, for its tranquillizing effect, and its promotion of the action of the skin, must not be neglected. Most authors advise only warm baths. But as the complaint is peculiar to hot weather, and is aggravated almost in proportion to the elevation of the temperature above 90° Fahr., the analogy of fevers certainly sustains the principle of a different practice. Experience shows that *cool* bathing may be decidedly beneficial in Cholera Infantum. Dr. C. G. Comegys[1] was one of the first to ascertain this. He reports successful use of baths at 75°, or even 65° Fahr.; introducing the patient rather gradually into the water. I prefer a method similar to that employed by Ziemssen in typhoid fever; placing the child in water at first at 85°, and then cooling it down to 75°; in which it may remain for ten minutes at a time. The bath may be repeated twice or more in a day. There are, of course, cases, especially advanced ones, in which actual coldness of the extremities forbids such a measure, and points instead to the application of artificial heat. Yet it may be remembered that, in the almost parallel condition of the collapse of epidemic cholera, hot baths give rather distress than comfort to the patient, and fail to do any good. Often, in both disorders, the

[1 Dr. Jacobi, of New York (Med. Record, July 26, 1879), and others advise giving skimmed milk in such cases. I can see nothing to favor this, either in reason or experience. Cream is, in most instances, with children and adults, quite as digestible as skimmed milk; and its elements are needed to make a perfect food.]

[2 I wish again to call attention to the important difference between home-made beef-tea *not filtered*, and that from which most of the nutritious principles have been removed by coagulation and filtration. Pouring it through a coarse sieve is all that ought to be done, besides removing the scum from the surface.]

[1 N. Y. Medical Record, June 26, 1876.]

rectal temperature is very high, while the hands and feet are shrunken and cold. Then, *enemata* of cold water may prove decidedly advantageous.

Some infants are so nervous, timid, and weak that putting them into the bath may agitate them overmuch. A tolerable substitute for bathing may then be obtained, by sponging them with cool, tepid, or warm water, according to their temperature.

With a view to the relief of gastric and intestinal distress, stimulating applications over the abdomen may be used with much confidence. The best of these in Cholera Infantum will be spice poultices. They may be made with any ordinary spices. I have been accustomed to having them made by stirring together a dessertspoonful each of powdered ginger, cloves, and cinnamon, with one or two tablespoonsful of Indian meal or rye (or wheat) flour; moistening the whole well with whiskey or brandy. Being spread (thin enough not to be too heavy) between two folds of gauze flannel, or soft muslin, the poultice should be laid upon the abdomen, and covered with a piece of oiled silk, or some similar material, to retard evaporation. Such a poultice, being wet with whiskey when partially dry, and renewed as soon as its strength is gone, may remain upon the belly day and night for several days together. If spices happen not to be at hand, similar effects may be obtained by applying flannel steeped in tincture of ginger, and covered with oiled silk. By this, however, the skin, in some children, may be rather unduly irritated if the application be prolonged.

Besides counter-irritation, as commonly understood, there is no doubt that (as suggested several years ago by Dr. Inman) a direct stimulation of the stomach and intestinal canal is effected by the absorption of aromatic essences, when spices are thus left in contact with the surface of the body.

Lastly, medicines may render great service in the treatment of this affection; but their injudicious employment is likely to do more harm in this than in most other disorders. At the beginning of an attack, what is needed chiefly is correction of a morbid state, rather than the immediate arrest of excessive discharges.

Calomel was once very largely used; now, I believe, it is too much disparaged and neglected. Large doses of it should be avoided. One-twelfth of a grain four times daily will suffice; and, without questioning the validity of the inferences of Rutherford, Röhrig, and others, from their experiments in regard to the action of calomel upon the secretion of bile, it has appeared to me to be experimentally shown that in small doses calomel does good in the early stages of Cholera Infantum. Clinical science does itself suicidal injustice when it refuses or neglects to place its chief dependence upon what is truly to be called experimental medicine. G. B. Wood, Niemeyer, Jacobi, and other physicians of repute, have contributed facts which sustain the opinion above given, which was formed by myself after considerable experience.

While diarrhœa is moderate calomel may be given (in doses as above mentioned) with small portions of magnesia; afterwards, or at first if the discharges are large and frequent, with two or three grains of sodium bicarbonate. To these may be added, in each powder, a grain or so of ginger.

Several writers recommend the early use of emetic and purgative medicines; as ipecac., castor oil, etc. I have never met with a case of Cholera Infantum in which such medication seemed to me suitable or allowable. Aromatic syrup of rhubarb is the only preparation approaching such a character that I believe to be called for. It is often very serviceable in the early treatment of the disease; and, in teaspoonful doses, it does not act as a cathartic, nor even as a laxative; but only as a corrective. Aromatic spirit of ammonia is a useful addition to it.

Subnitrate of bismuth is recommended by a number of authors, among them Drs. J. L. Smith,[1] Jacobi,[2] and Banks.[3] A favorite medicine with Drs. Meigs and Pepper for arrest of vomiting and diarrhœa, is a combination of two drops of aromatic sulphuric acid with five drops of solution of morphia, in a teaspoonful of iced water, every hour.

Opium must be employed with great caution in this disease. In large doses it may do harm by increasing cerebral oppression. Yet, when the diarrhœa is exhaustive, and restlessness wearisome, particularly at night, paregoric in five- or ten-drop doses may be given by the mouth, or a drop or two of laudanum by the rectum. In the acid mixture above mentioned, the same indication is met by the solution of morphia. Dr. A. A. Smith, of New York, uses hypodermic injections of morphia with quinine. Camphor has a most valuable composing influence in this as in other disorders of infancy. In the form of camphor water, it may be given (in teaspoonful doses) without hesitation, where opium may be of questionable fitness to the case.

When the diarrhœa does not yield to such treatment as has now been spoken of, astringents are needed. Krameria, hæmatoxylon, geranium, blackberry root, catechu, kino and others are used, with

[1] N. Y. Med. Record, May 25, 1878.
[2] Ibid., loc. citat.]
[3] Prize Essay, p. 29.]

very similar advantages, by different practitioners. None has pleased me better here than tincture of catechu. Crabs' eyes (oculi cancrorum) in powder, made into a mixture with gum arabic and diluted cinnamon water, are recommended by Meigs and Pepper, and are certainly less trying to the stomach than the conventional chalk mixture. Another agreeable preparation, spoken highly of by the same authors, is aromatic syrup of galls. Their formula for this is as follows :—

℞. Gallæ Opt. Pulv. ℥ss
Cinnamon. Pulv. ʒij
Zingib. Pulv ʒss.
Sp. Vini Gall. Opt. Oss.—M.

Let the ingredients stand in a warm place for two hours, and then burn off the brandy, holding some lumps of sugar in the flames. Strain through blotting paper. Dose, 15 to 40 drops every 3 or 4 hours.

Dr. Boardman Reed[1] has obtained good results with corrosive sublimate in minute doses.

Nitrate of silver has been a good deal used by many physicians. Given by the mouth it has disappointed me. Probably it is, in part at least, converted into an inert chloride in the stomach or upper part of the intestinal canal. It seems to do more good when administered by the rectum. It must, for such use, be well diluted—one-twentieth of a grain to half a fluidounce of water.

Acetate of lead should be reserved for use only when a very positive astringent effect is demanded by continued and obstinate diarrhœa. It may be given by the mouth, in very small doses, along with acetate of morphia in solution ; or in enema, two or three grains of acetate of lead in a tablespoonful of starch, with the addition of one, two, or three drops of laudanum. Dr. E. W. Lee[2] recommends suppositories containing each one grain of iodoform, with opium and extract of belladonna.

Creasote might be expected to aid, in this disease, in checking vomiting and abating the diarrhœa. I have used it a number of times with this hope, but without such decided advantage as was looked for. If serviceable at any time, it will probably be in the stage of chronic (sequelar) diarrhœa. Its dose in any instance must be small ; from the eighth to the tenth or twelfth of a drop at once.

Alcohol has, in many cases of Cholera Infantum, an important usefulness. Like opium, however, if given too freely, it will do positive harm. Very seldom will there be advantage in giving to an infant under two or three years of age larger doses of brandy or whiskey than ten drops ; and half as much at a time will often do more good. The time for it is when collapse is threatened ; or when, from prolonged vomiting and diarrhœa, or the latter alone, the energies of the system flag and need support. It had best be given, usually, with such nourishment as the child can take ; and it should be withdrawn as soon as decided improvement affords good promise of convalescence. It has been ascertained that even young children may acquire a morbid liking and craving for stimulants, which may be dangerous to their later welfare.

Supposing the dangers of an acute or subacute attack of Cholera Infantum to have passed by, slowness of recovery may call for directly tonic medication. A mild preparation of this kind is the bitter wine of iron. For more positive chalybeate effect, we may resort to the tincture of the chloride ; or, when astringency is still indicated on account of lingering diarrhœa, the pernitrate of iron. If the debility appear to affect the nervous system predominantly, or great relaxation of the alimentary canal is apprehended, tincture of nux vomica may be cautiously administered. There is no better *stomachic;* besides its special nervine power.

During slow convalescence, variety in diet, avoiding of course indigestible articles, will be important. Instead of beef-tea, some physicians (Trousseau among them) have preferred *raw* beef or mutton, chopped very fine, pounded in a mortar, and strained through a sieve. Well as this answers for nourishment, Weisse, Von Siebold, and Leidy have pointed out the danger it may involve of conveying tape-worm into the bowels of the child. Solid food of any kind, even when the patient has cut most of his teeth, must be ventured upon very gradually. Fruits and vegetables require the most care in this regard, and yet it must be recollected that monotony of diet is not favorable to the best condition of the digestive organs.

Salt bathing, even at a distance from the sea, may essentially promote the renovation of tone in the system. The temperature of the bath must be proportioned to the child's capacity of reaction ; being made as cool as appears to be borne with refreshing, not chilling, effect.

When the convalescent can have the advantage of a stay by the sea-shore, or in a mountainous country, until the summer is fairly over, the difficulties in the way of recovery of strength will commonly be slight, unless there be some underlying constitutional defect or predisposition other than belongs to the attack of Cholera Infantum itself.]

[1 Phila. Med. Times, Jan. 31, 1880.]
[2 N. Y. Med. Record, Sept. 20, 1879.]

DISEASES OF THE RECTUM AND ANUS.

By Thomas Blizard Curling, F.R.S.

An acquaintance with the numerous disorders of the lower bowel is absolutely necessary to qualify the medical practitioner to form a right diagnosis and judgment of the diseases of adjacent organs, as well as of the alimentary canal. Thus, complaints of the rectum are liable to be mistaken for affections of the uterus and even of the bladder; a discharge from a fistula in ano has been supposed to proceed from the vagina. Patients have been treated for obstinate diarrhœa, when the actual disease has been stricture in the lower bowel, or a lacerated perineum and sphincter; and obstructions referred to the abdominal intestines have been discovered when too late to exist in their pelvic termination. The following is a table of the diseases of the rectum and anus; they can be treated of only very concisely in the space allotted to this subject:—Congenital Imperfections; Hemorrhoids; Prolapsus of the Rectum; Irritable Ulcer; Irritable Sphincter; Nervous Affections of the Rectum; Villous Tumor of the Rectum; Polypus of the Rectum; Fistula; Chronic Ulceration; Stricture; Cancer; Atony; Anal Tumors and Excrescences; Prurigo Ani.

Congenital Imperfections of the Anus and Rectum. — These may be classed as follow:—1. Imperforate anus, without deficiency of the rectum. 2. Imperforate anus, the rectum being partially or wholly deficient. 3. Anus opening into a *cul-de-sac*, the rectum being partially or wholly deficient. 4. Imperforate anus in the male, the rectum being partially or wholly deficient, the bowel communicating with the urethra or neck of the bladder. 5. Imperforate anus in the female, the rectum being partially deficient, and communicating with the vagina or uterus. 6. Imperforate anus, the rectum being partially deficient, and opening externally into an abnormal situation by a narrow outlet. 7. Narrowness of the anus. A few other congenital deviations have been observed, but they are of very rare occurrence, the seven forms enumerated above being those most commonly met with.

The classification of these imperfections is founded on states which can generally be recognized during life. Unfortunately the condition of the terminal portion of the intestinal canal, and its relations to the parts around, cannot be predicated with any certainty. In cases of imperforate anus, or of anus opening into a *cul-de-sac*, the intestinal canal may terminate in a blind pouch at the brim of the pelvis, the rectum being wholly wanting; or an imperfect rectum may form a shut sac, descending to the floor of the pelvis, oras low as the neck of the bladder in the male, or the commencement of the vagina in the female. It is known that the anal portion of the bowel is developed distinctly from the upper portion, and that the two afterwards approximate and unite, the diaphragm or septum disappearing by interstitial absorption. A failure in this process is the cause of the second form of congenital imperfection. The cases of imperforate anus in which the rectum communicates with the urethra or vagina depend on the original existence of a cloaca, the malformation being due to an incomplete separation during fœtal life. These conditions are the result of an arrest of development at different stages. The blind pouch in which the intestinal canal terminates is sometimes connected to the anal integument, or to the anal *cul-de-sac*, by a cord prolonged from the bowel above. These cases are not, like the preceding, the result of a non-formation of the rectum, but are produced by an obliteration of the bowel, which was originally well formed; the obliteration being a pathological change due probably to ulceration and adhesion which had taken place during intra-uterine life.

These imperfections of the rectum can be remedied only by operative measures which vary according to the nature of the irregularity; and this treatment unfortunately often fails in obtaining a vent for the feces, or in securing a permanent and sufficient passage. In cases of failure in reaching the bowel at the natural site, life may still be preserved by making an artificial anus either in the left loin or in the left groin. For several reasons the latter is the best situation for the operation in infants.[1]

[1] See "Observations on the Rectum," by Mr. Curling. 3d Edit. p. 221.

HEMORRHOIDS. — The hemorrhoidal veins distributed in the submucous tissue at the lower part of the rectum communicate in loops, and form a plexus which surrounds the bowel just within the internal sphincter. The veins are best seen when somewhat congested, their deep purple hue being very apparent through the thin mucous membrane with which they are in close contact. The plexus is then found to be about three quarters of an inch in length, and composed of veins of various sizes, arranged for the most part lengthwise and in clusters, being especially collected in the longitudinal folds of the rectum. The plexus does not extend lower than the external sphincter, but veins branching from it pass between the fibres of the internal sphincter, and descend along the outer edge of the former muscle close to the integuments surrounding the anus.

These veins are very liable to become dilated and varicose, giving rise to the disease termed *hemorrhoids* or *piles*. When the plexus beneath the mucous membrane is thus affected, the hemorrhoids are said to be *internal*. When the veins beneath the integuments outside the muscle are enlarged, the hemorrhoids are called *external*. Both external and internal piles very frequently coexist.

We may distinguish two kinds of external piles. 1. A sanguineous tumor. 2. A cutaneous excrescence or growth. The sanguineous tumor consists of a softish elevation of the skin near the margin of the anus of a rounded form, and of a livid or slightly blue tinge. On cutting into it we find a dark-colored coagulum inclosed in a cyst. This kind of pile is generally single, and seated at the side of the anus, but a second may form at a subsequent period. The second form of external pile consists of flattened prolongations of skin. They are generally the chronic results of the first form, a projecting fold left after absorption of the coagulum having undergone further growth. The cutaneous excrescence contains no clot, and no enlarged or varicose veins; but clots and dilated veins may often be found at its base. There is sometimes only a single broad flat excrescence at the side of the anus; but there are often two, one on each side, and occasionally more. Similar excrescences occur as the result of irritating discharges from the bowel, and are common in stricture and ulceration of the rectum.

The changes in structure consequent upon internal hemorrhoids vary a good deal. In general the lower veins of the hemorrhoidal plexus are dilated irregularly, or into pouches, which are filled with dark compact coagula. A bunch of varicose veins crowded in the lower ends of the longitudinal folds produce prominent projections of the mucous membrane, and deepen the pouches between the folds. Two or three of these prominences unite so as to form a transverse fold just within the sphincter. After a time the mucous membrane and submucous tissue become greatly hypertrophied. Thus are developed elongated processes of a polypus form, and projecting transverse folds. The arteries, which are abundantly supplied to the lower part of the rectum, enlarge considerably, so that the mucous membrane involved is not only thickened, but extremely vascular. Such are the changes found in dissection, but the description conveys only a faint and incomplete impression of the condition of the parts observed during life.

Internal piles seldom attract attention until they have become developed so as to protrude at the anus in defecation. They then exhibit a remarkable diversity of appearance according to their number, size, and condition. The protrusion may consist of only one good-sized pile, found usually towards the perineum or front of the anus. A single pile, consisting of a bright red projecting membrane connected with a loose fold of integument, and readily extruded, often forms in young persons, especially women. More commonly, there are three distinct prominent growths differing in size, one at each side of the anus, and a third in front; the latter, the perineal, being the largest. In old-standing cases they may be more numerous. The distinction between the piles is commonly well marked, but not always; for the piles sometimes merge into each other, the protrusion forming a circular prominence. The aspect of extruded piles depends much upon their condition, whether congested, inflamed, or constricted by the sphincter. In a relaxed condition of the sphincter, they form softish tumors of a red granular appearance; but when protruded and congested, they constitute large tense tumid swellings of a deep red color and smooth surface, which readily bleed. When hemorrhoids of large size are fully protruded, the integuments at the margin of the anus become everted, and form a broad band girting the base of the tumors externally.

External and internal piles often coexist, the sphincter forming a narrow band separating the two. But the two forms may merge into each other, the difference being recognized by the character of the covering, mucous membrane or skin, the line of junction being visible on the surface of the tumors. Internal piles are confined to the lower border of the rectum. They never occur, as has been asserted, higher up the bowel, so that when they are entirely removed, there is

very little liability to a recurrence of the disease.

Hemorrhoids is a disease of middle and advanced age. They rarely occur before puberty, and but few persons in after-life altogether escape them. All those circumstances which determine blood to the rectum, or which impede its return from the pelvis, tend to produce this disease. In many persons there is a natural predisposition to hemorrhoids, and this may be hereditary. The complaint, indeed, often occurs in members of the same family who inherit the local weakness of their parents. But a predisposition is more frequently acquired by sedentary habits, indulgences at table, and excitement of the sexual organs, which explains the well-known circumstance that hemorrhoids are more prevalent in the higher classes of society than amongst the laboring population. The latter take plenty of exercise, live a good deal in the open air, and are little liable to constipated bowels. Hemorrhoids, though common in both sexes, occur more frequently in males than females. Few women bear children without becoming in some degree affected by them; but the urinary and genital disorders of the other sex, combined with freer habits of living, are still more fertile sources of piles.

The symptoms produced by hemorrhoids vary a good deal in different subjects and in different stages of the complant. External piles cause a feeling of heat and tingling at the anus. A costive motion is followed by a burning sensation, and the excrescence becomes slightly swollen and tender on pressure, so as to render sitting uneasy. This congested state of the pile may subside, or it may lead to inflammation and considerable enlargement of the hemorrhoid, which then forms an oval tumor, red, tense, and extremely tender. The irritation produced by costive evacuations, or by friction in sitting and cleansing the part, sometimes gives rise to ulceration on the inner surface of the pile, causing a sore which extends a little within the circle of the sphincter. This is liable to occur particularly to those growths at the margin of the anus which hold a middle place between internal and external piles. The pain in these cases is rather severe, being a burning sensation lasting for some time after defecation.

Internal piles, when slight, may exist for years, causing little inconvenience besides slight bleeding after a costive motion, and occasionally a feeling of fulness, heat, and itching, just inside the anus. When small they protrude slightly with the mucous membrane in defecation, returning afterwards within the sphincter. When of larger size, they always protrude at stool, and require to be replaced, the patient usually pushing them up with his fingers. In a lax state of the sphincters, and a loose and hypertrophied condition of the mucous membrane from which they spring, piles come down, even when the patient stands or walks about. When thus exposed to view they appear very prominent, of a rounded form, and often of a deep purple or violet hue, have a soft feel, and are evidently very vascular, bleeding readily when handled. If free from congestion, they exhibit a florid red color, with a rough, granular surface. In consequence of the friction and pressure to which they are exposed, their mucous surface becomes abraded, and furnishes a mucous discharge tinged with blood, which soils the linen. They are often so sore that the patient is obliged to lie down, sitting causing great uneasiness.

Persons frequently suffer no inconvenience from piles until, irritated by a costive motion, smart purgation, or the excitement of wine, they become congested and inflamed, and cause spasm of the sphincter muscle. Patients then have what is termed an "attack of piles"—that is to say, they suddenly experience a sensation of heat, weight, and fulness just within the rectum followed by considerable pain at stool, and sometimes irritation about the bladder. Piles in this state are liable to be strangulated and constricted by the external sphincter, and hemorrhoids of large size have been known to slough off, the patients being relieved of the complaint by a sort of natural process, after much pain and suffering. In general the extremities only of one or two of the larger hemorrhoids perish, and the patient, though experiencing relief, is by no means cured of the complaint.

One of the most common symptoms of internal hemorrhoids, indeed, that from which the name of the complaint is derived, is hemorrhage, which occurs when the bowels are evacuated. The bleeding varies greatly in amount. Sometimes the motions are merely tinged with a few drops of blood; in other instances the quantity lost is considerable, several ounces being voided at stool. The bleeding may be irregular, occurring only after costive motions, or in certain states of health; or it may take place daily, going on even within the bowel, and producing the usual symptoms of derangement from continued losses of blood. The complexion becomes blanched, and the lips appear waxy. The patient loses flesh and strength, has a quick and small pulse, suffers from throbbings in the temples, palpitations and difficulty of breathing on making any exertion, and at length the legs and feet become œdematous. The character of the bleeding also varies; it is sometimes venous, sometimes arterial.

There are persons who are liable to discharges of the blood from the hemorrhoidal veins either at regular periods or when from good living or want of exercise the habit is fuller than usual. In these cases from three to six ounces of blood, or even more, pass away at stool, following the evacuation, and the blood which is voided is of a dark color and evidently venous. Such discharges must not be rashly interfered with. I had under my care a gentleman, seventy years of age, who had been subject to hemorrhoidal discharges for many years, usually in the spring and autumn. After lasting a week or ten days they generally ceased, but not always, and when faint and weak from their continuance he was in the habit of arresting them with cold-water injections. The discharges at length ceased, but in six months afterwards his urine became albuminous, and a year later he died suddenly after an attack of epistaxis. Periodical losses of this character relieve congestion of the liver and kidneys, help to ward off attacks of gout, and prevent fits of apoplexy, so that in many person they are rightly regarded as safety-valves. Persons who suffer from internal piles sometimes experience a pretty copious discharge of blood from the rectum. The bleeding shortly ceases, and all uneasy symptoms subside. This hemorrhage is also venous. The escape of blood unloads the congested parts and the patient gets relieved. But the bleeding which most commonly occurs from internal piles is undoubtedly arterial, taking place from arteries enlarged by disease. The vessels on the spongy surface of the mucous membrane readily give way when blood is determined to the part in defecation or when abraded by the passage of hard feces. An artery of some size, exposed by ulceration, continues to pour out blood, weakening the patient, and giving rise to the symptoms above described. Sometimes a small artery on the prominent part of a protruded pile may be observed pumping out blood. That hemorrhage of this character is good for the health is quite a mistaken notion, and it is important that the practitioner should distinguish the bleeding taking place as a consequence of local disease from that which arises from a constitutional plethora or congestion of the intestinal organs.

When piles are small, and cause but little inconvenience, the treatment is very simple. In all cases attention should be paid to the habits of living. Persons with this complaint should take wine in great moderation, if at all, and they are in most instances benefited by abstaining entirely from stimulating drinks. Many individuals never suffer from piles, except after taking a glass of spirits and water, or a few glasses of wine. Such persons should become rigid water-drinkers. Active exercise in the open air should be taken daily, and the patient should avoid sitting too long at the desk, because it is by prolonged sedentary occupation and neglect of the rules of health that hemorrhoid complaints are induced, which explains why literary persons so often suffer from them. Chairs with cane seats are to be recommended. The bowels must be carefully regulated, so as to avoid hard and costive motions, as well as frequent actions. Irritating the rectum by repeated purging is more hurtful even than constipation. On the other hand, when the liver is congested, or its secretions are sluggish, and when the bowels are costive, a mild cathartic, by clearing the intestines, especially the large, unloads the congested vessels and relieves the piles. Lenitive electuary, rendered more active when necessary by the addition of the tartrate of potash, will probably answer the purpose. The foreign mineral waters, the Pullna or the Friedrichshall, taken in the morning, fasting, agree well with many patients, and insure a comfortable relief. When the intestines require fully unloading, a draught containing rhubarb powder and the tartrate or sulphate of potash answers without producing local irritation. Half a pint of cold spring water thrown into the rectum in the morning after breakfast has a very beneficial effect on the hemorrhoids by constringing the vessels and softening the motions before the usual evacuation. The relief afforded by this treatment, combined with care in the mode of living, is often remarkable. Ordinary venous bleeding may be stopped in this way, using iced water, or some astringent such as a solution of tannic acid or infusion of rhatany. When the bleeding is of an arterial character, astringent injections are not so successful, and operative treatment often becomes necessary. When there is a slight slimy discharge from the surface of an exposed internal pile, benefit may be derived from the application of mild citrine ointment or the application of the solid sulphate of copper to the part.

External piles, when large and troublesome, and internal, when of such a size as to protrude at stool, and to be subject to inflammation, ulceration, and frequent bleeding, can be removed only by operation. [Much relief, however, may often be given by local applications. At the beginning of an attack, or exacerbation, of piles, it does a great deal of good to apply a simple unguent, as lard or cold cream, *very frequently* to the parts, especially after each passage from the bowels.

Useful also, in many cases, will be the following: Ointment of galls, with half a

scruple of opium in each ounce; cerate of carbonate of lead (two drachms of white lead in an ounce of simple cerate); belladonna ointment; benzoated vaseline, containing in each ounce two drachms of oxide of zinc and a scruple of iodoform. Dr. F. P. Atkinson[1] advises pitch ointment. Dr. D. Young,[2] the internal use of glycerin. As a laxative, sulphur has long had a deserved reputation. Dr. H. C. Wood[3] recommends enemata containing chlorate of potassium with laudanum. —H.]

Prolapsus of the Rectum.—In describing the changes occurring in piles, it was remarked that internal hemorrhoids slip down and project at the anus. The descent of these growths is often attended with more or less eversion of the hypertrophied mucous membrane of the lower part of the rectum. In relaxed states also of the sphincter muscle and coats of the bowel, loose folds of mucous membrane are liable to protrude and to require replacement. This protrusion and exposure of the thickened mucous membrane with or without internal hemorrhoids has been erroneously described by writers as prolapsus of the rectum. In the true prolapsus, however, there is a great deal more than an eversion of the internal surface of the bowel. The gut is inverted; there is a "falling down" and protrusion of the whole of the coats—a change in many respects analogous to intussusception, but differing from it in the circumstances that the involved intestine, instead of being sheathed or invaginated, is uncovered and projects externally.

The length of bowel protruded in prolapsus varies greatly, from an inch to six inches or even more. The shape and appearance of the swelling depend partly upon its size, and partly upon the condition of the external sphincter. When not of any great length, the protrusion forms a rounded swelling which overlaps the anus, at which part it is contracted into a sort of neck. In its centre there is a circular opening, communicating with the intestinal canal. An inversion of greater extent usually forms an elongated pyriform tumor, the free extremity of which is often tilted forwards or to one side, and the intestinal aperture assumes the form of a fissure receding from the surface of the tumor, owing to the traction exerted upon it by the meso-rectum. In a relaxed state of the sphincter the surface of the protrusion has the usual florid appearance of the mucous membrane; but in other cases it is of a violet or livid color, and tumid from congestion, the return of blood being impeded by the contracted sphincter. The exposed mucous membrane is often thickened and granular, and sometimes ulcerated from friction against the thighs and clothes. A thin film of lymph may be occasionally observed coating its surface. On examining the section of a large prolapsed rectum from a child, I found the coats of the protruded bowel greatly enlarged; the areolar tissue was infiltrated with an albuminous deposit, the muscular tunic hypertrophied, and the mucous membrane much thickened and dense in structure, especially at the free extremity of the protrusion. These changes account for the difficulty in reducing the parts, and in retaining them afterwards, so often experienced in the treatment of this complaint in children, the bowel having become too large to be conveniently lodged in its natural position, and, like a foreign body, exciting the actions of expulsion. The atonic and relaxed state of the sphincter muscle in these cases is well shown by the facility with which one or two fingers can be passed through the anus even in children.

Prolapsus of the rectum is observed most frequently in children between the ages of two and four, but is liable to occur at a later period of life. In infancy it is produced by protracted diarrhœa; the frequent forcing at stool so weakening the coats and connections of the rectum, and relaxing the sphincter, as at length to lead to inversion of the bowel. The straining efforts to pass water consequent upon stone in the bladder often give rise to prolapsus in early life. In adults the descent results chiefly from a weakened condition of the sphincter and levator ani muscles, and a general relaxation of the tissues of the part. The rectum being imperfectly supported by the perineum, the eversion at stool gradually extends until an actual inversion takes place, and this may increase until it forms a protrusion of considerable size. Prolapsus in adults is more common in women than in men. In the former it results in a great measure from weakness in the parts consequent upon child-bearing.

The annoyance and inconvenience occasioned by a prolapsus of the rectum vary considerably under different circumstances. Thus the bowel may descend only in a very slight degree at stool, and disappear by a natural effort afterwards, or it may come down only occasionally, admitting of being easily thrust back, and, when returned, will remain in its place until an attack of diarrhœa or the effort to pass a costive motion causes it to fall again. Prolapsus sometimes occurs after every motion, and even when the patient stands or moves about, forming a large red unsightly tumor exposed to friction,

[1 Practitioner, August, 1879].
[2 Practitioner, Octobor, 1879.]
[3 Phila. Med. Times, Dec. 6, 1879.]

feeling sore, soiling the linen with a bloody discharge, and requiring to be pushed back frequently during the day. Or the gut may be constantly protruded, being fixed so as not to admit of replacement. There are cases on record in which a prolapsed bowel has become strangulated and inflamed, and has even mortified and sloughed off, similar to what sometimes happens to an invaginated intestine.

Young persons generally outgrow this complaint by the period of puberty; and common as is prolapsus in early life, it is rather rare in grown-up subjects. I have known, however, of persons, who have had this disease in childhood, and lost it, becoming affected with a return of it in after-life from the effects of a diarrhœa. In adults prolapsus is commonly attended with a slimy discharge of mucus tinged with blood, and, in some instances, with troublesome bleeding. The hemorrhage does not occur from any particular spot, but as an exudation from the congested mucous surface when the bowel is protruded at stool. As the cause producing the bleeding is constantly recurring, there is sometimes considerable difficulty in arresting it, local applications having little effect so long as the bowel continues to descend.

In children, irritability of the bowels and diarrhœa must be checked and disordered secretions corrected by suitable remedies. Attention must be paid to diet, and when the powers are feeble benefit will be derived from quinine or steel. In slight cases it will be sufficient to direct the nurse, when the rectum comes down at stool, to place the child on its face across her lap, and to return the parts by taking a soft cambric handkerchief or sponge wetted in cold water, in both hands, and by gentle but steady compression to push the protruded gut back into the pelvis. The relaxed state of the membrane may be corrected by administering regularly every evening an astringent injection, such as the decoction of oak bark with alum, the infusion of rhatany, or the muriated tincture of iron diluted. The child should also be kept at rest in bed, and be made to relieve its bowels in the recumbent posture until the strong tendency to prolapsus has been corrected. The chief difficulty is to retain the parts after they have been reduced. A piece of sponge or cotton wool, moistened in an astringent lotion, may be lodged at the anus and secured there by approximating the buttocks by means of a broad strip of adhesive plaster applied across from one side to the other, and further secured with a T-bandage. When the surface of the prolapsed bowel is ulcerated, it should be painted with a solution of nitrate of silver. In cases of stone, the prolapsus generally disappears after lithotomy.

Prolapsus in the adult requires surgical treatment to contract the opening of the anus by escharotics or operation. In old and unhealthy subjects the trouble may be remedied by a well-fitted rectum supporter.

Irritable Ulcer and Fissure.—The mucous membrane of the lower part of the rectum is arranged in longitudinal folds, which disappear in the expanded state of the bowel. These folds terminate below at the external sphincter. Just within this structure and between the folds, the mucous membrane is slightly dilated, variously in different subjects, but in many to such an extent as to form small sacs or pouches. Beside these folds, and in the spaces between them, there is a series of short projecting columnar processes, about three-eighths of an inch in length, separated by furrows or sinuses more or less deep, which are arranged around the lower part of the rectum. In the evacuation of the rectum, foreign bodies or little masses of hardened feces are liable to be caught or detained in the pouches just described. It is in these little sinuses thus exposed to irritation, abrasion, and rent, that a superficial circumscribed ulcer is formed. On examining the ulcer without distending the rectum, the lateral edges only being presented to view, the breach of surface has the appearance of a *fissure*—the term commonly given, but improperly, to the sore, which though often originating in a rent is obviously more than a mere cleft or fissure in the mucous membrane of the bowel. Such an ulcer may occur in any part of the lower circumference of the rectum, but is usually found at the back part. It is quite superficial, and though sometimes circular is generally of an oval shape, its long axis being longitudinal and its lower extremity extending within the circle of the extended sphincter. On tactile examination the breach of surface and size of the sore can be readily distinguished. With the speculum, the ulcer being fully exposed, is clearly seen not to be a mere fissure but a superficial sore. The surface is of a brighter red than the surrounding membrane, and has the usual indented appearance of an ulcer. A small pedunculated pile or polypoid growth, attached to the opposite side of the bowel, is frequently found in these cases. The growth lodges in the ulcer, adding to the irritation and the difficulty of cure.

The amount of suffering produced by this superficial ulcer varies a good deal, but the sore is generally extremely sensitive, and occasions severe distress. It is so situated that the feces in their passage outwards, rub over its surface, and the pain-

ful contact excites spasm of the sphincter muscle, causing a sharp burning pain, and often a forcing sensation, which lasts for two or three hours, the distress being usually greater after defecation than during the act; and in some instances an interval, varying from five to ten minutes or more, elapses between the evacuation and occurrence of pain. The pain is sometimes so acute that patients resist the desire to pass motions, and allow the bowels to become costive in dread of the sufferings brought on by evacuating them. I have known persons to deprive themselves of food in order to avoid an action. In one case, the intensity of suffering led the patient to adopt the dangerous course of inhaling chloroform whilst sitting on the close stool, and he could not be persuaded to go to the closet without this remedy.

The irritable ulcer occurs usually in middle life, and is more frequent in women than in men. It is met with as often in single as in married women. Though the symptoms are characteristic, the sore is often overlooked. On the attempt to separate the margins of the anus, or to dilate the sphincter to get a view of the ulcer or even to introduce the finger, spasm with an aggravation of pain is, in most cases, immediately excited, and the orifice becomes strongly contracted, and forcibly drawn in. When this is the case, it is better to desist, and to get an assistant to administer chloroform. Under its influence the sphincter yields completely, and the practitioner is able to ascertain the exact seat, character, and extent of the ulcer. In cases free from spasm, a good view may be obtained by simply dilating the anus with the two forefingers or by introducing a speculum.

The irritable ulcer seldom heals under the influence of local applications. The treatment necessary is an incision through its centre, including the superficial fibres of the sphincter muscle, in order to place this muscle at rest, to enlarge the passage and displace the sore; thus removing those sources of irritation which prevent its healing. An incision is not invariably required; but in all cases in which the pain is considerable, and in which there is much spasm of the sphincter, the attempt to procure the healing of the sore by local applications so often protracts the patient's sufferings, and so constantly ends in failure, that it is not desirable to make it. In cases complicated with a pedunculated pile or polypus, this growth must also be excised. When the suffering is moderate, a cure may be attempted by giving a laxative to insure soft evacuations, rest in the recumbent posture, and the application of mercurial ointment with morphia, belladonna, or chloroform. [Iodoform suppositories are advised by Dr. J. C. Peters.[1] Dr. W. H. Van Buren, of New York, operates for fissure by *forced dilatation* of the sphincter, instead of incision. The two thumbs of the operator are used to overcome the spasmodic contraction of the muscle, so as to act upon the ulcer in the same manner as by its division.—H.]

Irritable Sphincter Muscle. — Persons occasionally suffer pain in defecation, especially during solid motions, increasing afterwards, and lasting half an hour or an hour. It is described as a forcing sensation, or a feeling as if the bowel were unrelieved. The anus is strongly contracted and drawn in by the action of the sphincter. Any attempt to examine the part induces spasm; and the finger passed through it is tightly grasped by the muscle, as if girt by a cord. In cases of old standing, the muscle becomes hypertrophied and forms a mass, encircling the finger like a thick unyielding ring. This irritability and hypertrophy of the sphincter sometimes produces serious trouble in defecation, owing to the expulsive powers of the bowel being insufficient to overcome the impediment caused by this muscle to the passage of the feces.

Irritability of the sphincter occurs commonly in hysterical females, or in nervous susceptible women, who are accustomed to watch and to intensify every sensation. The treatment required is mild laxatives, the local application of an ointment containing chloroform, opium, or belladonna, and the occasional passage of a bougie coated with a sedative ointment. The bougie gives great relief in those cases in which an irritable sphincter offers resistance to the passage of the feces. In obstinate cases a partial or complete division of the sphincter may be necessary to remove the difficulty.

Nervous Affections of the Rectum. — The symptoms as well as the causes of these complaints are usually obscure, and the diagnosis is often perplexing. On analyzing the symptoms, they appear to consist, in some instances, in an irritability, or a too frequent inclination to relieve the bowels; in others, in a morbid sensibility or undue tenderness of the part; and more rarely in an exaltation of sensibility independent of contact, constituting neuralgia.

1. *Irritable Rectum.*—In derangements of the alimentary canal, and of the organs connected with it, the feces are often unhealthy and irritating to the mucous membrane; consequently when passed into the rectum they excite uneasiness.

[1] Phila. Med. Times, Nov. 8, 1879.

with an urgent desire to void them. Pressing and painful calls are also experienced when the bowel is ulcerated and in other ways diseased. In "the irritable rectum" there is an inclination, more or less urgent, to empty the bowel, usually at inconvenient times, although the mucous membrane, as well as the feces, are healthy, and often when there is little or nothing to expel. Thus, a country rector experienced an urgent desire to relieve the rectum in church, just before and during the performance of divine service, notwithstanding an effort in the closet had just previously proved ineffectual. He was subject to it also when attending public meetings and whilst riding in a railway carriage. Persons living in the country and going daily to business by railway are sometimes annoyed by a desire to go to the closet just as the train is coming up, and during the journey to town, but it passes off as soon as they arrive at the counting-house and get engaged in business. The complaint is often connected with an anxious fidgety state of mind, against which patients may often successfully struggle. My patient, the rector, got relief from a gentle aperient on Saturday, and a mild opiate suppository administered on Sunday morning.

2. *Morbid Sensibility of Rectum.*—Several cases have fallen under my notice in which uneasiness has been experienced at a particular spot in the rectum, being complained of, chiefly, during or after defecation. The fixity and sometimes severity of the pain, and its aggravation from pressure, have naturally led to the suspicion of the existence of some lesion in the mucous membrane, such as an ulcer: but on careful examination, no breach of surface has been discovered; nothing has been observed except in some instances slight elevations and increased redness and vascularity at the spot affected, and occasionally abrasion of the mucous membrane. The complaint consists chiefly in an exalted sensibility of the nerves of the part, but the alterations in appearance just described indicate that there is also some slight and superficial structural change. The remedies for the complaint are chiefly local. Sedatives, such as opium and belladonna, passed into the rectum give relief, but more permanent benefit may be derived from applications calculated to alter the character of the part, such as the sulphate of copper or a strong solution of the nitrate of silver applied through a speculum. I have in several instances cured severe morbid sensibility in this part by two or three caustic applications.

3. *Neuralgia of the Rectum.*—The two forms of nervous affection already described would be included by some writers under the general term of *neuralgia*, the sensibility of the rectum being in a measure perverted or augmented; but it will be remarked, that in the first no actual pain is experienced—there is merely an irregular and often causeless desire to evacuate the part; while in the second, the uneasiness consequent upon the augmented sensibility is either produced or aggravated by friction and pressure. In true neuralgia of the rectum, the pain is severe, but quite independent of contact. There is no tenderness. In the cases of neuralgia which have fallen under my notice, the pain was not characterized by paroxysms, by a suddenness of attack and disappearance, or by any regular intermittence, nor was the pain of an acute kind, but it was described as a continuous enduring pain, or a constant gnawing sensation, sufficiently severe to interfere seriously with the comforts and even the business of life. The pain was in no degree mental, for the patients were not persons of an anxious nervous temperament, and, unlike the two other forms of nervous affection, occupation and amusement had little influence in mitigating their troubles. The remedies calculated to give relief are such as are useful in neuralgia elsewhere, as quinine, steel, arsenic, bromide of potassium, local sedatives, and hypodermic injections, and they are as uncertain in removing the affection of the rectum as in curing neuralgia of other parts.

In some instances it is impossible to refer nervous complaints of the rectum to either of the forms just described, morbid sensibility and neuralgia being so combined as to prevent any distinction being drawn.

Villous Tumor of the Rectum.—A growth similar to the villous tumor which occurs in the bladder and on other mucous surfaces sometimes forms in the rectum. It was first described by Mr. Quain under the name of a "peculiar bleeding tumor of the rectum;" but as it closely resembles the outgrowths found in the bladder called *villous*, I prefer the latter term. The tumor springs from the mucous membrane generally by a broad base, is soft in structure, and composed of a number of projecting papillæ or villi. On minute examination it is found to vary in structure according to the proportion of the fibrous or vascular elements entering into its composition. The villous tumor is innocent in character, and is not apt to return after complete removal. Its chief peculiarity in the rectum, as in the bladder, is a remarkable disposition to bleed. This growth is a rare disease, and occurs only in adults.

When it projects at the anus, it exhibits characteristic projecting processes of a deep red color.

The bleeding to which this growth gives rise and the slimy discharge render its removal very necessary. If the tumor be attached high up, and a ligature can be applied round its base, this is desirable, as it would be difficult to arrest bleeding after excision.

POLYPUS OF THE RECTUM occurs in two forms—the *soft* or *follicular*, and the *hard* or *fibrous*. The soft polypus forms generally in early life. Its essential element is a considerable agglomeration of elongated follicles. There is a network of small vessels on its surface which is also furnished with papillæ. The polypus is attached to the mucous membrane of the rectum by a narrow peduncle which varies in length. The polypus is generally single, but several have sometimes been found. The follicular polypus usually makes its appearance external to the anus in children after a stool, and it resembles a small strawberry, being of a soft texture, granular on its surface, and of a red color. It produces no suffering, but causes usually a slight bloody discharge, which, occurring after every motion, excites attention. In some instances the bleeding is sufficient to weaken the patient. The description of the complaint by the mother or nurse is apt to mislead the practitioner and to induce him to conclude that the case is common prolapsus. The growth can generally be detected by the finger passed into the bowel; and when the peduncle is long enough, the tumor is forced out at stool, and its nature can then be ascertained without difficulty. The follicular polypus occurs very rarely in the adult.

The treatment of polypus in children is very simple and always effectual. The tumor should be strangulated by a ligature secured around the pedicle and then returned within the bowel. This causes no pain, and the polypus comes away with the motions two or three days afterwards. Excision is not quite safe, as it is liable to be followed by bleeding.

The fibrous polypus is of a pear shape, with a peduncle more or less long and thick. It varies in firmness, seldom bleeds, but occasions a slight mucous discharge; and when the peduncle is long, or the tumor low down, it protrudes at the anus after stool, and requires replacement. When lodged within the bowel, it causes a sensation of unrelief, as if a foreign body or feculent lump required discharge. The polypoid growth sometimes becomes congested, and when protruded in this state its peduncle is liable to become girt by the sphincter, which causes great pain. The suffering is still greater when, as frequently happens, the polypoid growth is complicated with an ulcer within the circle of the sphincter. The polypus, coming in contact with the ulcer, irritates it, and prevents its healing.

The polypus must be removed by ligature or excision; and if an ulcer also exists, it must be divided at the same time.

FISTULA.—The loose areolar tissue around the lower part of the rectum is occasionally the seat of abscess, which bursts externally near the anus. But instead of the part healing afterwards like abscesses in other situations, the walls contract and become fistulous, and the patient is annoyed by a discharge from the opening. Such is the complaint termed *fistula in ano*. The abscess giving rise to fistula sometimes forms with all the characters and symptoms of acute phlegmon, suppuration taking place early, and the matter coming quickly to the surface. But more frequently a thickening appears at a spot near the anus with scarcely any sign of inflammation, and but little local pain, and is gradually resolved into a fluctuating swelling, which being opened discharges a fetid pus. On introducing a probe at the external orifice of a fistula formed in either way, it may pass through a small opening in the coats of the rectum into the bowel; the case is then called a *complete fistula*. When there is no internal opening, the complaint is named *blind external fistula*. The external orifice is usually but a short distance from the anus, its situation being often indicated by a button-like growth, and it is in the centre of this red projecting granulation that the opening is found. The aperture, however, is not always so marked, and being very small—a mere slit concealed in the folds of the anus—it cannot be detected without careful search. The abscess, before breaking or being opened, may have burrowed to some distance, and the external orifice may then be placed two or three inches from the anus in the direction of the buttock or perineum. An abscess may make its way into the bowel before bursting externally, but the inner opening is generally formed after the external, and is small in size. The sinus burrows close to the mucous membrane of the rectum, which forms a thin barrier between the bowel and the sinus. Ulceration ensues at one point, and thus is formed the internal orifice of the fistula. The orifice is most commonly just within the sphincter: a fact established some years ago by M. Ribes, and fully confirmed by later observation. The inner opening, however, sometimes forms higher up the rectum, as I have clearly ascertained both in the living and dead

subjects. Ulceration of the mucous membrane, from the wound of a fish bone or from other causes, may perforate the bowel just within the sphincter, and, allowing the escape of the feculent matter into the areolar tissue around, may give rise to abscess and fistula. Fistula occurs in phthisical subjects, originating in tubercular ulceration of the mucous membrane and perforation of the bowel. In these cases the inner orifice is usually large in size, and there is sometimes a second opening. Though the inner orifice is most commonly found just within the sphincter, the fistula itself often extends some distance up the side of the rectum, as far as two or three inches, or even higher, and it may burrow in different directions. When the sinuses are tortuous, or pass in different directions, there may be more than one inner opening. Sometimes there is an external orifice on each side of the anus leading to fistulous passages which pass to the back of the rectum, and communicate with the gut at this part by a single orifice, so as to form a sort of *horse-shoe fistula*. The matter is liable to lodge in these complicated sinuses, to give rise to inflammation, and to lead to fresh abscesses and additional fistulous passages. In old-standing cases, the walls of the fistulous passages become dense and callous, feeling gristly to the finger. In all cases of complete fistula the occasional escape of a little feculent matter into the passage is amply sufficient to prevent the part healing, even if the actions of the levator and sphincter ani and the movements of defecation did not also interfere. Authors have described *blind internal fistula*, in which an opening into the bowel leads to a fistula without any external orifice. Such cases are rarely met with. The external opening sometimes closes for a short time, the spot being indicated by redness and induration; but sooner or later it reopens, and the discharge returns, or a fresh opening is made at some distance off. It may happen, however, that the original ulcerated opening in the rectum being large, the matter from the abscess in the areolar tissue outside finds its way so readily into the bowel that the abscess does not burrow towards the surface. The situation of the suppurating cavity may be ascertained externally by a sort of hollow or indistinct fluctuating feel. A bistoury plunged into this will render the fistula complete. A blind internal fistula is very liable to be overlooked. I have met with several instances in which this has happened. In one case, the discharge, which was abundant and kept the linen constantly soiled, was supposed to proceed from the vagina.

An anal fistula is at all times an annoying complaint. Even when the seat of the disease is free from all inflammation and tenderness, the patient is troubled with a discharge which stains the linen and keeps the part uncomfortably moist. The discharge is usually a thin purulent fluid; at other times it is thick, and in complete fistula tinged brown from admixture of feculent matter. The discharge is more or less copious in different cases, and varies also at different times. It occasionally becomes so thin and scanty that the patient supposes the fistula is about to close, when he is disappointed by fresh irritation being set up, and the complaint becoming as annoying as ever.

Anal fistula is a disease of middle life, and occurs more frequently in men than in women. It is occasionally met with in young children, but rarely forms in advanced life, owing partly to the laxity of the rectum and sphincter in old people rendering the mucous membrane less liable to irritation and injury, and partly to the relief obtained by discharges from the hemorrhoidal veins when congested.

The treatment necessary during the formation of the abscess, which precedes the establishment of a fistula, is rest in the recumbent posture, fomentations or the hip-bath, a poultice to the part, and mild laxatives. As soon as fluctuation can be felt, the prominent or central part should be punctured freely, to prevent the matter burrowing in the loose areolar tissue, and thus to limit the extension of the sinuses. Fomentations and poultices must be continued until inflammation has subsided and the suppurating sac has become fistulous and indolent. An examination may then be made. This, as well as the cure of anal fistula by operation, is entirely surgical.

Chronic Ulceration of the Rectum.—The rectum is subject to ulceration in dysentery and other diseases, the mucous membrane being destroyed to a greater or less extent. Chronic ulcers of a tubercular character also occur in this part, but they are generally small in size. Several cases of ulceration in the rectum, the origin of which must be ascribed to syphilis, have fallen under my notice, and this symptom is probably less rare than is commonly supposed. Syphilitic ulcers are usually large in size, and often involve the deeper structures of the coats of the rectum, so that the healing process is very apt to cause a serious contraction of the passage.

The chief symptoms referable to chronic ulceration of the rectum are—a purulent discharge from the anus more or less copious; motions generally loose and mixed or coated with a slimy fluid, and streaked with blood; soreness in passing stools, and occasionally tenesmus. The pain in defecation varies considerably, being in

some cases severe, in others very slight. Indeed, it is surprising how little suffering is often caused by the actions of the rectum and passage of the feces in cases of large ulceration of the mucous surface. The suffering much depends on the position of the ulcer. Whether it be large or small, if it extends low down, so as to come within the grasp of the sphincter muscle, the pain is generally severe and persistent after defecation, and, in addition to other treatment, an incision through the lower margin of the ulcer is often required to release it from the actions of the sphincter.

The character, position, and extent of chronic ulceration in the rectum must be ascertained by examination with the finger and with the speculum. The surgeon will be able to feel a rough, uneven surface, more or less indented or depressed, and frequently hardness and consolidation of the walls of the rectum. The appearance of the sore in the lower part of the bowel may be seen through a glass speculum with an open end made oblique and large. This instrument is also very useful for the application of local remedies.

The treatment suitable to chronic ulceration greatly depends on the nature and extent of the disease, and upon the constitutional condition of the patient. In severe cases, I always keep the patient at rest in the recumbent position. In extensive destruction of the mucous surface with relaxed and copious discharges, especially when the disease originates in dysentery, vegetable astringents, such as simaruba, krameria, and bael, combined with the mineral acids and opium, are generally of great service in restraining the tenesmus and irritating evacuations and discharges. The subnitrate of bismuth with magnesia and anodynes often affords great relief. In many cases sulphate of copper with opium may be given with advantage. When the ulceration is consequent on syphilis or scrofula, the remedies appropriate to these diseases are required. The diet must be carefully regulated. The local treatment consists in the repeated application of weak solutions of nitrate of silver, and anodyne injections with mucilage, or anodyne suppositories.

STRICTURE OF THE RECTUM.—The rectum, like other mucous canals, as the œsophagus and urethra, is liable to obstruction from contraction of its walls, forming the disease called *stricture*. The contraction may be very limited in extent, and the stricture is then termed *annular;* or the contraction may include a portion, more or less considerable, of the bowel. The submucous tissue is the chief seat of disease, and is condensed and converted into close-set fibrous tissue. The thickening of the coats of the bowel may be confined to part only of its circumference, or may be greater on one side than on the other, contracting the canal irregularly and forming a winding passage; or the induration, instead of being limited to a small portion of the bowel, may involve the greater part or the whole of the gut. The peritoneum investing the contracted bowel generally retains its healthy structure and appearance. Above the stricture the rectum is usually dilated and thickened. The enlargement results, not from a yielding of the intestine, but from a general hypertrophy of the walls of the bowel, and particularly of the muscular coat. The mucous membrane at this part is rarely healthy. It is red and tumid, or eroded and ulcerated, the diseased surface supplying during life a purulent discharge. There are often ulcerated apertures leading to fistulous passages which extend for some distance and open externally near the anus or in the buttock. The bowel below the stricture is generally more or less diseased, and frequently studded with small excrescences arising from partial hypertrophies or irregular growths of the surface and folds of the mucous membrane. These excrescences tend to narrow the canal below the stricture.

The seat of stricture in the rectum is at about an inch and a half to two inches from the anus, and easily within reach of the finger. In twenty-eight cases I found the stricture at this distance in twenty-one. In two it was nearer the anus, and in five at a greater distance. In three of the latter the stricture was at the point where the sigmoid flexure terminates in the rectum. In two instances I have met with double stricture.

The pathological changes causing stricture originate in chronic inflammation of the mucous and submucous areolar tissue of the rectum. It is seldom possible to fix on the exciting cause, but it is well known that the part is exposed to numerous sources of irritation. Women, in whom the disease is much more common than in men, have sometimes ascribed its origin to a difficult labor, by which no doubt the bowel may be injured, so as to set up chronic disease. In twenty cases of women with stricture of the rectum I ascertained that the disease commenced shortly after a labor, and in some instances was attributed to an injury at that time. Injuries such as a kick, and violent use of an enema tube, have also been known to give rise to stricture. Strictures sometimes originate in the contraction consequent upon the healing of ulcers or wounds in the bowel, more commonly indeed than is generally supposed. In extensive dysenteric and syphilitic ulceration of the lower bowel the passage is liable to become seriously contracted in this

way. I have met with several cases of stricture of this kind.[1] The rectum may also be obstructed by an outgrowth of fat, or by an infiltration of fat in the coats of the bowel. This is a very rare form of stricture. There is a specimen of it in the Museum of St. Thomas's Hospital, and Mr. Worthington has related a case in the *Transactions of the Pathological Society* (vol. xv.). In the Museum of the London Hospital also there is a large fibrous and fatty tumor developed outside of the rectum and contracting the passage.

Stricture of the rectum is a disease of middle life, being seldom met with in young persons except as a consequence of some injury. It is rare also in old people. The disease generally occurs between the ages of twenty and fifty.

The earliest symptom of stricture is, generally, habitual constipation with difficult defecation when the motions are solid. The difficulty being readily removed by a solvent purgative, the nature of the case is not usually suspected at this early period. As the contraction increases, the constipation is overcome with difficulty, and the patient acquires the habit of straining. The stools are observed to be small in calibre, and are often voided in small lumps. The mucous surface, irritated by the disturbance in the functions of the rectum, becomes inflamed and excoriated. This renders the action of the bowels painful, a burning sensation lasting for an hour or more after stool. There is also a secretion of brown slimy mucus, which escapes with the motions and soils the linen. The gases involved in the intestines not escaping readily, give rise to flatulent distension of the abdomen, especially in the course of the descending colon, and to disagreeable efforts for relief. The bowels often remain constipated for days together, and then a spontaneous mucous diarrhœa, excited by the fecal collection or by a strong cathartic, softens the motions and enables the patient to void the accumulated mass, its passage being attended with pain. In other instances, the patient is teased with frequent fluid evacuations, and urgent desires to pass them. As the disease makes progress and ulceration ensues, the discharges become purulent and bloody, and the sufferings are much increased, the passage of motions being likened by the patient to a feeling as if boiling water was passing through the rectum. At this period, pain is often felt in the sacrum. The discharges are sometimes so copious that the stricture is overlooked, the case being mistaken for one of protracted diarrhœa. Ulceration often leads to abscesses and fistula, sinuses in the buttocks and labia being common complications of old-standing stricture of the rectum. The appetite and even the general health often remain good for a long time. The disease is very chronic; and so long as a passage for the motions can be obtained, the patient continues to follow his avocations, suffering more or less at different periods. The derangement of the digestive functions, the irritation kept up by the disease, and the exhausting discharges from the lower bowel in the course of time undermine the constitution and bring on hectic symptoms. The appetite fails, the body emaciates, profuse night-sweats ensue and the stricture directly or indirectly becomes the cause of death. This is sometimes hastened by a lodgment of hardened feces, or of some foreign body just above the stricture, so as to block up the bowel and occasion the symptoms of internal obstruction. Such an obstruction is sometimes the cause of an examination of the rectum, and thus leads to the detection of a close stricture previously unsuspected.

In order to detect a stricture it is necessary to make a tactile examination. On exposing the anus small flattened excrescences are usually observed at the margin of the aperture. These cutaneous growths resemble collapsed external piles, except that they are redder in color, and are kept moist by the escape of a thin discharge from the bowel. They originate in the irritation kept up by this discharge. The finger, well greased, being passed carefully and gently into the rectum, will be arrested on reaching the stricture, so that the point only can enter. If the contraction be somewhat recent and not very close, the finger may be carried with a gentle boring motion through the stricture so as to examine its whole extent. If the practitioner encounters much resistance or gives much pain, he must not venture to force the barrier, but must be content with ascertaining the seat and degree of contraction. In strictures high up in the gut, the rectum below may be found quite healthy, but it is often dilated and baggy with weakened expulsive powers. In strictures low down, the interior of the rectum is often abundantly studded with the small excrescences which I have described, which communicate to the finger the feeling of a number of rough irregular eminences, more or less hard, thickly lining the surface. This condition is invariably attended with a profuse discharge from the bowel of pus and slimy matter mixed with blood. A stricture high up in the rectum, and beyond the reach of the finger, is sometimes difficult of detection. In a suspected case the bowel must be explored by a flexible instrument. When

[1] See my "Observations on Diseases of the Rectum." Third Edition. P. 119.

the passage is free, a good-sized flexible gum elastic tube may always be passed into the colon. The point is apt to impinge on the sacrum, or to be caught in a fold of the bowel; but if some warm fluid, water or linseed-tea, be injected somewhat forcibly through the tube, a space is formed, admitting the easy transit of the instrument. In stricture, pain is felt when an instrument reaches the point of contraction, and a flexible one is arrested or passed on with more or less difficulty. In examinations for stricture it must be borne in mind that the rectum is liable to be compressed and obstructed by disease of the neighboring viscera—by an enlarged or retroflected uterus, fibrous tumors of this organ, a distended ovary, an excessively hypertrophied prostate—an hydatid tumor between the bladder and rectum, or an outgrowth of fat, such as I have described.

The main object in the treatment of a stricture in the rectum is to remove the chronic induration and to dilate the contracted part sufficiently to admit a free passage for the feces. The dilatation of the stricture is to be effected by mechanical means—by the passage of bougies, and sometimes by operation as well. The treatment, therefore, is chiefly surgical. An organic stricture fully established is universally admitted to be most difficult of remedy, and several high authorities, such as Dupuytren, Dr. Bushe, and Dr. Colles of Dublin, doubt the possibility of the disease being cured. These writers have undoubtedly taken too unfavorable a view of the results of treatment. In addition to the dilatation, means must be adopted to relieve the irritability of the part, to insure the regular passage of soft evacuations. An opiate suppository or injection may be lodged in the bowel at bedtime; and if the motions are costive, some confection of senna, castor-oil, or Püllna water may be taken in the morning, in doses just sufficient to obtain an action of the bowels without purging. Castor oil is often of great service. In small doses it softens the feculent masses, and lubricates the passage without weakening the patient. Cod-liver oil is also an excellent remedy. It nourishes the patient and softens the motions, rendering aperients unnecessary. The diet should be nutritious, and consist principally of animal food, so as to afford a small amount of excrementitious matter. It is no needless caution to advise patients to be careful to avoid swallowing plum stones. Accumulations in the bowel above the stricture may be prevented by the occasional passage of an elastic tube through the contraction and an injection of soap and water. We sometimes meet, especially in hospital practice, with old, inveterate, and neglected strictures, in which the disease is too far advanced and the mischief too great to admit of relief by dilatation. In such cases, when the sufferings are severe, I have proposed the operation of lumbar-colotomy, and have performed it in two cases.[1]

CANCER OF THE RECTUM.—The coats of the rectum are subject to cancerous degeneration in the three forms of scirrhous, encephaloid, and colloid. The disease invades the coats to a greater or less extent, producing contraction of the canal, and it is liable to increase until it narrows the passage to such an extent that only a probe can pass through it. Fungoid growths sometimes spring from the mucous membrane at the side of the rectum and project into the bowel. Occasionally the bowel becomes blocked up and occluded by fungous masses. In other cases the changes which ensue have a contrary effect, degeneration and softening causing the coats to yield, and increasing the calibre of the canal. A description of the progress of cancer of the rectum, and of the changes that occur in the advanced stage, is a description of the disorganization and invasion of all the tissues of the part, and of the organs in its immediate neighborhood, in various degrees in different cases. In some instances the carcinomatous bowel becomes wedged in the pelvis, agglutinated and fixed to the surrounding parts, forming one mass of disease. Frequently softening and ulceration cause fistulous communications with neighboring parts—with the vagina in the female, and with the bladder or urethra in the male; or the peritoneum may become perforated, and an opening made into the abdominal cavity. When the passage is contracted, the intestine above becomes dilated and hypertrophied as in simple stricture. Carcinoma may attack any part of the bowel, but it generally affects the lower portion within three inches from the anus. It is liable to occur also, though less frequently, at the point where the sigmoid flexure terminates in the rectum. The disease is sometimes limited to the rectum and adjoining parts, though the lymphatic glands in the pelvis and lumbar regionoften become affected, the liver being invaded by tubercles and the peritoneum also studded with scirrhous deposits.

Cancer of the rectum generally commences insidiously. Its early symptoms are so similar to those of simple stricture, that the nature of the disease cannot be determined, or may not be suspected, until a considerable change has taken place

[1] *Vide* London Hospital Reports, vol. iii. [See also a paper by Dr. Lente, of New York, in Amer. Journal of Med. Sciences, July, 1873, p. 29.—H.]

in the condition of the bowel. The patient is troubled with flatulency, has difficulty in passing his motions, and strains in the effort to void them; and as the disease makes progress, he experiences pains about the sacrum, which gradually increase in severity and dart down the limbs. By this time, probably, some alarm is excited, and an examination may be called for. The practitioner on introducing his finger into the rectum may easily detect a contraction more or less rigid; and should he feel any irregular nodules about the stricture, any hard solid tumor, or encounter a resistance like cartilage, or meet with softish tubercles which leave a bloody mark on the finger, then he would be able to decide on its being carcinomatous. At a later period no difficulty could be experienced. There is a hard mass of disease in which it may be difficult to discover the orifice of the passage, and sometimes round fungoid growths which bleed readily when touched. The disease may extend as low as the anus. An irregular red-looking growth sometimes protrudes externally, blocking up the passage or displacing the anus. The stools become relaxed and frequent, and contain blood, and in passing cause a scalding pain and give rise to severe suffering. There is often a thin offensive discharge, and as the disease invades the sphincter, incontinency ensues. The loss of retentive power is often a great trouble in cancer of the rectum. This arises not only from the disease invading the anus and destroying the sphincter muscle, but occurs also when cancer is developed higher up in the bowel, the lower part being free. This may be explained by the carcinomatous disease pressing or destroying the nerves supplying the sphincter and so paralyzing it. The sufferings also increase. Severe shooting pains are referred to the groins, back, or upper part of the sacrum, and sometimes extend down the thighs and legs. The constitution suffers in due course. The patient acquires a blanched sallow look, anxious countenance, and emaciated appearance commonly observed in persons suffering from malignant disease. If complete obstruction does not accelerate a fatal termination, other troubles may arise. In consequence of a communication becoming established between the rectum and urethra or bladder in males, flatus and liquid feces escape from the urinary passage, and in females motions are discharged from the vagina. The passage of part of the intestinal contents by these unnatural channels greatly increases the misery of the patient's condition, rendering him an object of disgust to himself and offensive to those about him. An ulcerated opening into the peritoneum, allowing the escape of feculent matter into the abdomen, may excite peritonitis, and thus bring the case to a fatal termination; or the powers of life gradually giving way, the patient becomes hectic and exhausted, worn out by this painful and distressing malady. There is great variety, however, in the degree of suffering, and even of constitutional derangement, attending the disease. Whilst in some cases the sufferings are excruciating, in others they are comparatively slight. In my experience patients suffer less from the disease when developed high up in the rectum than when formed near the anus.

Cancer of the rectum occurs generally in middle life. The earliest age at which I have met with it is twenty, the patient being a young man in the London Hospital. It is commonly believed that this disease attacks women more frequently than men. This does not accord with my experience of cases seen in hospital and private practice. Of seventy-three cases of which I have preserved notes, fifty-seven were males and sixteen females.

All that can be obtained from remedies is palliation of the symptoms, ease from pain, and support under the wearing effects of this terrible disease. The patient should remain at rest, chiefly in the recumbent posture, and take a nourishing but not stimulating diet. The general health may be supported by tonics. The bowels must be kept open and the motions rendered soft by Püllna water or small doses of castor-oil. If the stricture be close, injections may be necessary through a long tube to break up the feculent masses. The greatest care is necessary in the passage of the tube, as if force be used the carcinomatus mass may yield and the tube be driven into the abdomen. Bleeding may be checked by injections of sulphate of copper and tannic acid. Pain can be alleviated by opiate and belladonna injections, or by small doses of morphia taken night and morning, their strength being gradually increased as the effects of the remedy diminish. Subcutaneous injections of morphia also are effectual in giving relief. So great were the sufferings in a recent case, that after a time as much as 3½ grains were thus injected twice a day.

In cancerous disease of the rectum attended with great suffering from incontinency and constant scalding discharges, I have advocated and performed in several cases colotomy in the left loin. By diverting the passage of the feces, the local distress can be in a great measure prevented, and I have reason to believe that the progress of the disease also may be retarded by the removal of a source of almost continual irritation. I have established an anus in the left loin in several

cases of cancer in which no obstruction existed, in order to mitigate the symptoms, with a satisfactory result in prolonging life and preventing suffering.[1]

Epithelial Cancer of the Anus and Rectum.—The anus, like other parts, where a junction takes place between the skin and mucous membrane, is liable to epithelioma. The affection is comparatively rare, and has seldom been noticed by writers. It is easily recognized by the ordinary characters of the sore. In the few cases which have fallen under my notice, the disease extended into the rectum, but there was no reason to doubt that its original seat was the anus. The only treatment applicable to this affection is caustics or excision. I prefer the latter, as more sure and thorough. Though more common at the anus, epithelioma may occur in any part of the mucous membrane of the rectum. When occurring up the bowel, the disease is apt to produce slight bleeding, but it is much less serious than scirrhous and medullary cancer. The latter produce sooner or later some contraction or obstruction in the passage, and show a tendency to involve the parts around. In epithelial cancer I have never noticed any impediment in defecation, and have invariably found the passage free and unobstructed. Neither do patients complain of the distressing pain, referred usually to the sacrum, which persons affected with scirrhus of the rectum so commonly experience, nor suffer painful tenesmus and defecation, which add so much to their distress in this form of the disease. There is also an absence of the cancerous cachexia, of the emaciation and pale and anxious countenance so frequently remarked in malignant disease. Epithelial cancer in the rectum may go on for years, but the patient becomes exhausted at last from repeated small bleedings. The hemorrhage is best restrained by injections of solutions of sulphate of copper, chloride of zinc or tannin.

Atony of the Rectum.—In paraplegia the forces which expel the feces and the retentive functions of the sphincter are both destroyed; consequently, the motions, if sufficiently liquid, on reaching the lower bowel escape involuntarily. I have not met with any well-marked case of paralysis of the rectum independently of palsy of the lower half of the body; but several instances of loss of tonicity or defective muscular power in the lower bowel, rendering it incapable of properly extruding its contents, have come under my notice. An atonic condition of the rectum may be produced by the too free and frequent use of enemata, the quantity thrown up being so large as to dilate the bowel and impair the power of its muscular coat. This condition is apt to give rise to fecal accumulations. Cases of this kind are not very uncommon, yet they are liable to be overlooked by practitioners. It appears that the rectum becomes gradually dilated and blocked up by a collection of hard dry feces which the patient has not the power to expel. Some indurated lumps from the sacs of the colon, on reaching the rectum, perhaps coalesce so as to form a large mass; or a quantity accumulated in the colon on descending into the lower bowel becomes impacted there. In several instances a plum-stone has been found in the centre of the mass. Such a collection gives rise to considerable distress and alarm, producing constipation, a sensation of weight and fulness in the rectum, tenesmus and forcing pains. In cases of some duration, when the hardened feces do not quite obstruct the passage, they excite irritation and a mucous discharge which, mixing with recent feculent matter passing over the lump, causes the case to be mistaken for diarrhœa. Injections have no effect in softening the indurated mass. They act only on the surface and return immediately, there being no room for their lodgment in the bowel. On digital examination the bowel is found to be distended and blocked up with a large lump which feels almost as hard as a stone. In such cases, the only mode of giving relief is by surgical interference. The mass requires to be broken up and scooped out. Sir James Simpson has described this affection under the head of "ball-valve obstruction of the rectum by scybalous masses."[1] Some years ago I saw a lady who for eighteen months had been unable to relieve her bowels without aperients and without passing her finger into the rectum. On examination I detected a hard elongated mass which was forced down in the effort of defecation and obstructed the anus until the finger pushed it back. I broke up this mass, and after the bowels had been relieved by injections the difficulty was entirely removed.

Anal Tumors and Excrescences.—Besides the flaps and folds of integument consequent on external piles, other growths are developed in the immediate vicinity of the anus. These tumors of a fibrous texture sometimes form in the subcutaneous areolar tissue, and as they increase become pedunculated. They seldom exceed the size of a chestnut, though I have known one to weigh half a

[1] *Vide* London Hospital Reports, vols. ii. and iv.

[1] Edinburgh Monthly Journal of Medical Science, April, 1849.

pound. They have a firm feel, and their surface is in general irregularly lobulated. These growths may be easily and safely removed by excision.

Warts are not unfrequently developed around the anus, and they sometimes grow so abundantly as to constitute a considerable cauliflower-looking excrescence. They then form projecting processes of various sizes densely grouped together, many being of large size, with their summits isolated, expanded, and elevated on narrow peduncles more or less flattened. I have seen a mass forming a tumor as large as the closed fist, separating the nates, and almost blocking up the passage for the feces. When abundant, they give rise to a thin offensive discharge. They originate in the irritation consequent on want of cleanliness, and occur generally in young adults of both sexes. I once saw a large crop of these growths in a child only four years of age. In some persons there is so strong a disposition to the formation of warts, that without great attention it is difficult to prevent their formation. If few in number and small in size, they may be destroyed with strong nitric acid. They usually require however to be removed by excision, which is the quickest and most effectual mode of treatment. Great cleanliness and the application of astringent lotions will be necessary to prevent their reproduction afterwards.

Prurigo Ani.—Itching at the anus is a common symptom in several disorders of the lower bowel, but it may also occur as a distinct affection, as independently of any other disease of the part, being due to a peculiar hyperæsthesia of the skin. Prurigo ani is caused by worms in the lower part of the rectum, and by congestion of the hemorrhoidal veins. In women it is consequent on affections of the womb. Patients suffer most after taking stimulating drinks, and during warm weather and when heated in bed. The itching is extremely teasing and annoying, especially at night, when it sometimes keeps the patient awake for hours. Rubbing the part to arrest the irritation only aggravates the mischief afterwards, yet few persons have sufficient self-control to prevent their seeking temporary relief by friction, and some, though capable of restraining themselves whilst awake, fret the part unconsciously during sleep. The friction thus resorted to excoriates the skin at the margin of the anus, so that in chronic cases the skin becomes dry, harsh, and leathery, cracks from slight causes, and ulcers and fissures are produced, which are but little disposed to heal. In most instances this complaint, after proving troublesome for an hour or two at night, and in the day after stimulants, ceases, and the patient has long intervals of rest and ease. But in the worst forms of the malady, the torment is most distressing. It lasts throughout the night, so that the patients get little but broken sleep, and after a time the general health suffers seriously, and life is rendered truly miserable. In some of the cases which have fallen under my notice, I could discover no local cause whatever to account for the prurigo. It seemed to be purely an affection of the nerves of the part. The patients are generally healthy. One gentleman who had been subject to it for years, found that it was connected with his state of mind. When much engaged and prosperous in business, he suffered little from it. He was sometimes free for a whole month, and then became troubled for many nights in succession. In cases of this kind the complaint, after proving troublesome for years, has been observed to subside as age advances.

In prurigo ani the habits of living should be regulated. The patient should sleep on a mattress, and be as lightly covered as is consistent with comfort, cold bathing or sponging should be daily resorted to, and sufficient exercise taken in the open air. Stimulants and hot condiments must be strictly avoided. The actions of the bowels are to be regulated if necessary by medicine, and after each evacuation the parts should be cleansed with soap and water. Every effort should be made to avoid friction, and the patient should be assured that if he yields to his inclinations, his complaint will be rendered worse and more difficult of cure. In all cases, the condition producing this troublesome symptom must be the chief object of attention, such as worms, congestion, &c., but there are certain remedies which are specially adapted to relieve the irritation. The itching attendant on piles may be arrested by smearing the anus with some mercurial ointment, as the dilute citrine, or one containing the gray oxide of mercury, or by lodging in the parts a piece of cotton-wool soaked in a lotion of oxide of zinc. Lotions of carbonate of bismuth and glycerine, of borax and morphia, or of carbolic acid, are often efficacious in this complaint. The application to the anus of strong solution of nitrate of silver (gr. xx—$\bar{3}$j) with a camel's-hair brush once daily often gives relief, especially in cases where the skin is made rough and sore by rubbing. In some cases great benefit has been derived from chloroform ointment. It produces a smarting sensation when first applied, but this is soon followed by ease. In persons of weak constitution benefit has resulted from full doses of quinine, and in certain cases liquor arsenicalis with steel has helped to relieve the irritation. I

have sometimes found it necessary in severe cases to order suppositories of morphia at bedtime. The complaint is often very obstinate, and much perseverance is required on the part of the practitioner, and also of the patient, to effect a cure.

[Moderate *dilatation of the anus*, at the time of an attack of pruritus, will often give relief. It may be effected, in mild cases, by the patient's own middle finger; in more severe attacks, by means of a rather large suppository of cacao butter, or tallow, which acts for a time like a bougie.—H.]

INTESTINAL WORMS.

By W. H. Ransom, M.D., F.R.S.

Introductory Remarks.—No definition of the disease, such as stands at the head of each article in this System of Medicine, is requisite or appropriate in treating, from the point of view of the practical physician, of the parasitic worms which inhabit the human alimentary canal. But it may be desirable briefly to indicate the general scope or plan of this article, as well as the limits within which it will be restrained.

In most diseases, as for instance in the exanthemata, a brief summary of the more constant phenomena may serve at once as a definition and means of diagnosis; but, as the external agents or exciting causes of those phenomena escape our search, the etiology of such diseases is little more than an investigation of the conditions favorable to their occurrence, with speculations upon the nature of the exciting cause: while the pathology is limited to a consideration of the relations existing among the phenomena observed during life or after death, and between these and the favoring conditions.

But in the medical study of parasites the whole question of "the changes from a condition of health" is viewed from quite another standpoint. Here we can begin with the exciting cause, which we can isolate, compare, experiment upon, and learn the natural history of, before we study its effects. The extension of knowledge may possibly hereafter enable us so to approach the study of cholera or scarlet fever.

In this article the order thus indicated will be followed; the names and zoological position of the worms found in human intestines being first stated, the more important species will be described and their life histories traced, with only so much of detail as may be required for the purposes of the medical practitioner. Afterwards the changes of function or structure which they produce, the conditions which favor their occurrence, the mutual relations of the observed phenomena, the methods of detecting, expelling, and avoiding these pests, will be treated of.

Those parasitic animals belonging to the Gregarinida and Infusoria, as well as the accidental or occasional but not truly parasitic inhabitants of our intestines, such as insect larvæ, will be excluded from consideration here on account of their at present comparative insignificance clinically. The *Trichina spiralis* will also be passed over, because, although it attains its state of sexual maturity in human intestines, its importance to the physician depends upon the habit which its larvæ have of perforating the tissues and becoming encysted in the muscles. Moreover the very great importance which has recently attached to this worm justifies the devotion to it of a separate article.

It is difficult, if not impossible, adequately to appreciate the relation of intestinal worms to their bearers without including in the investigation the lower animals. To do so here would, however, be foreign to the design of this work, and the reader who seeks for fuller information on this subject will do well to consult the works of Kückenmeister, Von Siebold, Davaine, Cobbold, and especially of Leukart. I may however draw attention to two prominent results of the comparative study of Entozoa. They are so widely diffused that scarcely any species of animal is known which is not, at least sometimes, infested by them; and notwithstanding the fact that they can, and do, often injuriously and even fatally influence the animals they infest, yet in the majority of cases the observer is struck with the apparently trivial inconveniences they produce.

History.—The intestinal worms, or some of them, have been known from very early times. Hippocrates mentions

the tape-worm, and Aristotle described in addition the round-worm and the seat-worm. During the classical and middle ages the doctrine of spontaneous generation held general sway, and was thought to afford a satisfactory explanation of the then known facts as to the occurrence of Entozoa. Although Swammerdam[1] and Redi[2] shook the foundations of this doctrine in its application to insects and their larvæ, they did not venture to apply their views to the Entozoa. The first great step towards sounder views was made by Pallas,[3] who taught that Entozoa, like other animals, sprang from similar parents, and were propagated by means of eggs which were transmitted from one host to another. But in the absence of direct evidence these opinions were for a time borne down by the authority especially of Rudolphi[4] and Bremser,[5] who reverted to the doctrine of spontaneous generation. Soon, however, the progress of biological science, aided by improved means of research, and directed into new channels, broke down this doctrine at once and for all time, at least in its application to intestinal worms; and the researches of Mehlis (1831),[6] Von Siebold (1835),[7] and Eschricht (1837)[8] confirmed the main proposition of Pallas, and justified the conclusion of Eschricht, that Entozoa during their reproduction generally undergo a metamorphosis and a migration. Then followed the brilliant discovery of alternation of generations by Steenstrup (1842),[9] the researches of Von Siebold (1848),[10] and Van Beneden (1850),[11] and the true life history of the *Trematoda* and *Cestoda* was understood. It remained to furnish direct proofs of the correctness of the new views, and these were given by Kückenmeister (1852),[12] who fed carnivora on flesh containing *Cysticerci* and produced tape-worms, and by feeding herbivora with ova of Tæniæ produced *Cysticerci*. Many other zealous and able investigators in this country, as well as in France and Germany, have confirmed his results, and otherwise extended our knowledge of the intestinal worms.

[1] Bibel der Natur. Ausdem Holl. übersetzt. 1752.
[2] Esperience intorne agl' Insetti. 1712.
[3] Neue Nord. Beiträge. 1781.
[4] Entozoor, hist. Natur, vol. i. 1808.
[5] Ueber lebende Würmer im lebenden Menschen. 1819.
[6] Oken's Isis. 1831.
[7] Archiv für Naturgeschichte. 1835.
[8] Nova Acta Academ. C. L., vol. xix. 1837.
[9] Ueber den Generationswechsel. 1842.
[10] Jahresbericht im Archiv für Naturgeschichte. 1848.
[11] Les Vers Cestoides. 1850.
[12] Prager Vierteljahrschrift. 1852.

Prominent among these stand the names of Haubner, Leuckart,[1] Dujardin,[2] Davalne,[3] and Cobbold.

The opinions of medical men as to the clinical importance of intestinal worms have varied with the changes of biological theory, usually lagging somewhat behind, but depending mainly upon it. So long as the doctrine of spontaneous generation in any of its forms was believed to account for the presence of Entozoa a mysterious dread of their power for evil prevailed, and evidenced itself by the multitude of grave diseases attributed to them. Indeed few maladies afflict humanity which were not sometimes attributed to intestinal worms, even by prominent men in their day.

This was due not alone to the common tendency to magnify the unknown, but also to the uncertainties of diagnosis, the absence of a pathological anatomy, and the frequency with which worms were observed to pass away in the course of serious diseases, the subsequent recovery from which being imputed to their escape.

In the latter half of the eighteenth century an extreme reaction took place among those who gave themselves specially to the study of Entozoa, so that it was maintained that they were beneficial to their hosts, or at most only very rarely and accidentally injurious.

The physicians as a rule, however, still clung to the older views, and in doubtful cases found a ready and satisfactory explanation of the symptoms in the assumption of an irritation by imaginary worms. Even Rudolphi and Bremser, while opposed to the prevalent medical opinion, sought to explain the actual symptoms which attended the presence of worms in the intestines by the hypothesis of a pre-existing diathetic state (Helminthiasis), which they believed to be a necessary condition of the spontaneous development of worms. Only in the present generation have sound views on this subject prevailed, and only since the discoveries of Kückenmeister and his followers has a satisfactory knowledge of the life history of human intestinal worms enabled the physician to appreciate their true importance in medicine, to ascertain their presence with certainty, and in most instances to point out how they may be avoided.

Out of at least thirty-one Entozoa which are at present known to inhabit our bodies, thirteen infest the alimentary canal. Of these seven belong to the order *Cestoda*:—

[1] Die menschlichen Parasiten, &c. 1862–68.
[2] Histoire Naturelle des Helminthes. 1845.
[3] Traité des Entozoaires. 1860.

1. *Tænia solium*, Linnæus.
2. *Tænia medio-canellata*, Kückenmeister.
3. *Tænia nana*, Von Siebold.
4. *Tænia flavo-punctata*, Weinland.
5. *Tænia elliptica*, Batsch.
6. *Bothriocephalus latus*, Bremser.
7. *Bothriocephalus cordatus*, Leuckart.

And six to the order *Nematoda*:—

8. *Ascaris lumbricoides*, Linnæus.
9. *Ascaris mystax*, Rudolphi.
10. *Oxyuris vermicularis*, Bremser.
11. *Dochmius duodenalis*, Leuckart.
12. *Trichocephalus dispar*, Rudolphi.
13. *Trichina spiralis*, Owen.[1]

Order *CESTODA*.

Parenchymatous worms, without mouth or alimentary canal, with a so-called water-vascular system. They develop by budding from a pear-shaped larval form (scolex) to a long, jointed, tape-shaped colony of individuals (strobila). In their reproduction they suffer an alternation of generations. The individual members of the colony (proglottides), or sexually ripe animals, increase in size and complexity of structure, although otherwise resembling each other, the further they are removed from the head, near to which a continuous formation of new joints takes place by budding. The head, which is the same in the adult as in the larval form, is furnished with two or four suckers, and commonly also with a coronet of hooklets, which serves for attachment. They infest in their adult state the alimentary canal of vertebrate animals only. The ovum yields a globular embryo furnished with three pairs of hooklets, and develops into the Scolex (*Cysticercus*) in the tissues or in parenchymatous organs, usually of food animals, and is thence passively transferred with the food into the intestine of its definitive bearer, where it assumes the adult form.

Tænia solium (Linnæus)

Was at one time believed to be "the common tape-worm of man," but it is now known that at least one other species is included in that expression.

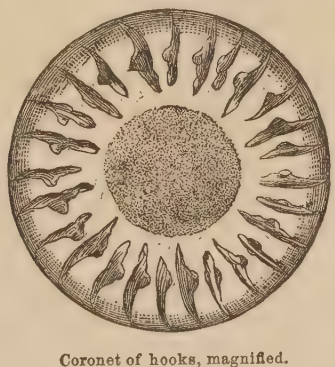
Fig. 28.

Tænia solium natural size. (Davaine.)

Fig. 29.

Head of *T. solium*. (Davaine.)

Fig. 30.



Coronet of hooks, magnified. (Leuckart.)

Fig. 31.

Separate hooks, more highly magnified. (Leuckart.)

Description.—The adult worm (Strobila, Fig. 28) commonly attains a length of from 7 to 10 feet,[1] but is often much longer.

[1] See article *Trichina spiralis*.

[1] This is Leuckart's measurement, but there is a wide divergence among authorities

The number of joints increases with the length; a worm measuring 7 ft. 6 in., counted by Leuckart, had 749 joints. The head (Fig. 29) has a somewhat globular form, measures about $\frac{1}{4\frac{1}{5}}$ in. to $\frac{1}{3\frac{1}{5}}$ in., is marked anteriorly by a moderately prominent rostellum, bearing a crown of about twenty-six hooks, and by four projecting suckers.

The threadlike neck is nearly an inch in length, and to the naked eye is not distinctly jointed; it passes gradually into a jointed, continually widening band of a whitish color, of which the earlier segments are so much shorter than broad that one-half of the whole are found in the anterior ninth of the chain. Slowly the joints increase in length more than in breadth, so that they assume a square

Fig. 32.

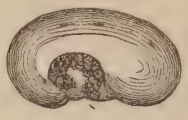
Ripe joints of *T. solium*, magnified. (Leuckart.)

form about the end of the anterior third. Mature joints, *Proglottides* or *Cucurbitina* (Fig. 32), measure about $\frac{1}{2}$ in. in length and $\frac{1}{4}$ in. in breadth, being now longer than broad. They are flat and thin, with a quadrangular outline, are furnished with a longitudinally placed tubular uterus, having seven to ten branches on each side, within which are seen developing ova. Male and female organs of generation are present in the same joint, and open by a common aperture near the centre of one or other border, now right, now left. The sexual organs are already distinctly visible in the joints at one-ninth of the whole length from the head, the ova are impregnated about another ninth lower down the chain, and soon afterwards the eggs enter the uterus.

on this point. Davaine makes the common length from 20 to 26 feet.

The water-vascular system consists of a single longitudinal canal at each border, and one transverse, near the posterior edge; it is continuous from one segment to another throughout the chain. The cystic worm known as *Cysticercus cellulosæ* is the larval form, or *Scolex* (Figs. 33, 34);

Fig. 33.



Cysticercus cellulosæ, natural size and position. (Leuckart.)

it is commonly found in the flesh of pigs, but occasionally also in other animals, and even in man: the adult colony has only been found in man. The eggs (Fig. 35)

Fig 34.

Cysticercuscellulosæ, magnified. Head and neck protruded. (Leuckart.)

are globular in form, measure when free about $\frac{1}{7\frac{1}{5}}$ in., have a thick firm shell of a brown color, radially and concentrically striated, and when taken from the uterus often an outer capsule with a more oval outline (Fig. 35, *a*). The contained em-

Fig. 35.

Ripe ova of *T. solium*. *a*, with outer capsule as seen in uterus; *b* free, as found in feces. (Leuckart.)

bryo is globular, and furnished with three pairs of hooklets. A moderate-sized tapeworm has been calculated to contain about 5,000,000 of ripe ova.

Life History.—The normal habitat of *T. solium* is the small intestine of man: Kückenmeister has seen it while yet alive

firmly attached by suckers and coronets to the mucous membrane. Formerly it was believed that it was always solitary, and this error perhaps explains the statements made by the older authorities of the occurrence of worms of enormous length. It is now known that although commonly one, two, or three are found together, yet various numbers, up to forty at least, may be present.

From the lowest end of the band—which hangs a variable distance down the intestines, and may reach the colon—ripe joints spontaneously separate and escape with the feces, either singly or united into short lengths. Frequently, also, ripe ova escape by rupture from the joints into the intestine and mingle with its contents. The free joints in moist and warm situations move about for a time, and by this and other accidental agencies the ova are widely disseminated; doubtless the vast majority fail to find suitable conditions for their development, and therefore die; but a small proportion of joints or ova are taken with the food into the stomach of a pig, or much more rarely into that of a man; where, after digestion and rupture of the shell, the embryo (*pro-Scolex*) escapes, and by diligent use of its armature perforates the tissues of its involuntary host, and ultimately settles down in some, to it, suitable locality, generally the cellular tissue of the muscles, but sometimes the liver or the brain. The embryo there remains quiet, in some organs is encysted, undergoes a metamorphosis, and becomes the well-known *Cysticercus cellulosæ* of measly pork (Figs. 33, 34). As usually found, it has the head and neck inverted, and its characters are difficult to observe, but when everted is seen to have a head and neck like that of *T. solium*, with a vesicular caudal appendage. This metamorphosis requires about two months and a half for its completion; afterwards the *Cysticerci* remain without further change, but capable of further development, if the proper conditions are supplied, for a period not yet certainly known, but which has been estimated at from three to six years.

When the flesh of pigs so infested is eaten raw or imperfectly cooked, the *Cysticercus* is partly digested in the stomach, so as to lose its vesicular annex; it then passes into the small intestine, and, attaching itself, becomes developed in about three to three and a half months into the adult form already described, which may continue to infest its bearer for ten, or even, it is said, thirty-five years. It would take too much space here to recount the evidence upon which this summary statement rests; but it may be said in brief that Kückenmeister, Leuckart, and others have, notwithstanding some opposing statements placed it beyond reasonable doubt by a carefully devised and executed series of experiments, in which pigs have been infected with *Cysticercus cellulosæ* by eating ripe joints of *Tænia solium*, and men have been infected with tape-worm by eating measly pork.

This biography of *T. solium* illustrates that of other parasites of the same group, and the study of each has thrown light upon the others: for this reason, and to show the relation between the food of animals and their parasites, the following short list may be permitted a place here:—

Cysticercus fasciolaria in the mouse is the larval form of *Tænia crassicolles* in the cat.

Cysticercus pisiformis in the rabbit is the larval form of *Tænia serrata* in the dog.

Cysticercus tenuicollis in sheep, oxen, &c., is the larval form of *Tænia marginata* in the dog.

Cœnuris cerebralis in sheep is the larval form of *Tænia cœnurus* in the dog.

Cysticercus tæniæ medio canellatæ in the ox is the larval form of *Tænia medio canellata* in man.

Symptoms.—There can be no question that a large proportion of persons infested with this tape-worm are unconscious of any departure from the state of perfect health, but there is as little doubt that in some instances functional derangements occur which are referable to the local irritation it produces. In a much smaller number of cases and under exceptional conditions, even structural changes are produced by it.

The functional derangements belong to two groups. (*a*) Those excited in the part irritated, and its immediate neighborhood. Such are, various uncomfortable sensations in the abdomen, pains resembling colic, sometimes felt when the stomach is empty, at others after certain articles of food, variable appetite, now excessive, now failing entirely, slight diarrhœa, or constipation, &c. (*b*) Those of reflex origin. These are itching of the nose or anus, headache, giddiness, ocular spectra, tinnitus aurium, palpitation, cardialgia, increased flow of saliva, nausea, lassitude, pains in the limbs, and an uncertain flow of spirits. In women, disordered menstruation, spasmodic and convulsive movements, hysterical fits, and even epileptic and maniacal attacks, have been said to be due to their irritation. In long-continued cases, Küchenmeister thinks wasting has been produced. This somewhat grave list of symptoms contains little or nothing that is characteristic of the nature of the irritative cause, and must be received with some caution, on two grounds; one, that patients not unfrequently exaggerate

their sensations when they either have had, or have suspected themselves to have had, worms of any kind; and the other, that the symptoms enumerated have in great part been collected and handed down to us from earlier times, when medical men, not yet familiar with the results of comparative helminthology, shared, to some extent, the common mysterious dread of Entozoa, and too hastily attributed the observed phenomena to the influence of worms, which were indeed present, but necessarily acting as exciting causes. In support of this assertion, it is sufficient to recall the fact that many healthy persons are infested with tape-worms, and present no symptoms; and also that many persons suffering from various diseases have tape-worms, and these more than other persons are apt to expel them, and thus mislead.

It may, nevertheless, be readily granted that those who have a delicate or irritable mucous lining to their intestines, or who are of a nervous temperament, and abnormally liable to reflex excitement, do suffer some, perhaps many, of the symptoms here recounted, and that in stronger persons the same may happen if the worms are very numerous. But it is worth remembering, that paroxysmal maladies, such as convulsions, mania, &c., are peculiarly liable to give rise to errors in reasoning as to their causes, so that very rarely could it be affirmed that they were caused by a tape-worm when their cessation coincided in time with its expulsion.

In some cases, proportionately few in number, when abscesses have formed in connection with an obstruction of the intestine, a tape-worm has escaped from the opening, and may have been partly, or perhaps solely, the cause of such obstruction and abscess.

There is another fortunately rare, but grave, consequence of the presence of a tape-worm; it may give rise to the development of the *Cysticercus cellulosæ* in the tissues or organs of its bearer, and thus even destroy life. This may conceivably take place when, as a consequence of violent vomiting, some of the ripe joints are carried up into the stomach, where the digestive fluids might set the embryo free; or in the case of children or dirty people, by conveying the escaped segments or free ova, upon the hands or with the food into the mouth, and thence into the stomach.

Diagnosis.—When a patient presents such a conjunction of symptoms as, in the absence of other indications, excites a suspicion of tape-worm, its presence can only be ascertained by an inspection of the stools. The ripe segments (Fig. 5) or the ova (Fig. 8, *b*), will with a little care almost certainly be found in the feces, and from them the species may be determined with sufficient exactitude for the requirements of the physician.

Etiology.—The exciting cause of the disease is manifestly the worm, a foreign irritating body in the intestine. The favoring conditions are the adult age, possibly the female sex, certainly some occupations, such as those of the cook or the butcher, the habit of eating raw or underdone pork, ham, sausages, &c., and a residence in Europe, India, Algeria, North America, and probably wherever the pig is domesticated.

Pathology.—Leuckart has shown by observations on the dog, that local congestions of the mucous membrane, separation of the epithelium, and even minute superficial sores, may result directly from the activity of a tape-worm. If it be admitted that *T. solium* may cause similar local changes in man, there is no difficulty in connecting the deranged functions of the alimentary canal with the worm as their cause, if we grant either an exceptional delicacy of the bearer, or an unusual number of worms. The remote functional disorders present no more difficulty, if pre-existing abnormal proclivity to reflex movements be granted.

Treatment.—The indications for treatment follow in the clearest manner from the foregoing. The worm as exciting cause must be got rid of, and the effects then commonly subside; but should they persist for a time, they can be successfully met by suitable diet and the treatment for irritation of the intestines.

An immense number of substances have at various times, enjoyed a reputation for the possession of anthelmintic powers, too often without any accurate distinction of the kind of worms, so that with the rise of a more accurate diagnosis, as well as, perhaps, of a more critical spirit in modern times, the number of accepted remedies for tape-worm has rather diminished, and a general demand has arisen for a re-examination of the claims of most of the reputed agents.

The Male Shield-fern (*Aspidium filix mas*) is perhaps the oldest and most widely known vermifuge, and of late has grown into much favor, especially in this country.

The dose is from 60 to 100 grs. of the powder of the dried rhizome, or from ʒj to ʒij of the liquid extract, given upon an empty stomach, preceded and sometimes followed by a purgative. It has been said to act by killing the worm; it certainly has a violent and irritating action upon the lining membrane of the stomach or bowels, often causing vomiting, and in large doses purging, with slimy and even bloody stools.

The Bark of the Pomegranate Root (*Punica granatum*), also an ancient

and extensively used remedy, is recommended by Bamberger as the best and least disagreeable in its action of all the remedies for the expulsion of tape-worm. He insists upon its being used fresh, and considers the old and dry bark almost inert. He prepares the patient by spare diet and aperient medicines, and then gives a pint of a decoction much like that of the British Pharmacopœia (equal to 2 oz. of bark) in three doses, at short intervals, early in the morning. Küchenmeister uses a still stronger decoction, and gives a quantity equal to 4 oz. of the pomegranate bark, with 20 grains of the ethereal extract of male fern added. The German authorities generally employ powerful, not to say violent measures, for the expulsion of the tape-worm, but how far this may be due to the greater resistance which some species present is unfortunately not yet certain.

Kousso—the flowers and tops of *Brayera anthelmintica*.—In doses of ¼ to ½ oz. or more it is a quick and good anthelmintic, much used in Abyssinia for the species of tape-worm there prevalent. It is not much used in Europe, perhaps on account of its cost, of the difficulty of obtaining it, and of the inconvenient form in which it is usually administered.

Kameela, from the fruit of the *Rottlera tinctoria*, *oil of turpentine*, and a number of other agents, have been recommended, but it is not desirable to notice them here. Some rare instances occur in practice, in which treatment by any or all of the above-mentioned drugs fails to expel the worm so as to prevent its recurrence, which takes place probably whenever the head and neck remain attached. Some cases, indeed, are recorded in which even the expulsion of the greater part of the band is not effected; and this not only when moderate doses have been used, but even after elaborate preparation, vigorous treatment, and free subsequent purgation such as Wawruch and other German authorities have advised. No very satisfactory explanation can be offered of this singular power of resistance occasionally met with; but in presence of the admitted failure of violent irritating remedies, it would seem prudent in such cases to continue moderate doses of male fern or pomegranate for longer periods of time, in conjunction with rigid prophylactic rules, to prevent the possibility of reinfection. [Ridder (*Allg. Med. Cent. Zeit.*, July 30, 1879) has treated two cases successfully with salicylic acid.]

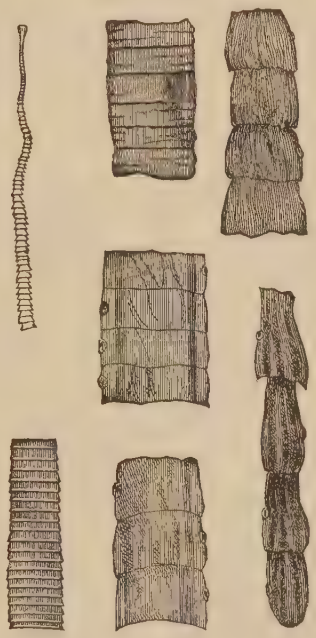
Prevention. — Each person can secure himself against *Tænia solium* by eating only such pork, ham, sausages, &c., as are well cooked; but the public health is not so easily cared for; it requires that pigs infested with measles should not be sold as food, and doubtless fewer pigs would suffer from measles were greater care taken to remove or destroy human excrement.

The *Cysticercus cellulosæ* when a human parasite, is treated of in another part of this work.

TÆNIA MEDIO-CANELLATA (Küchenmeister).

Description.—This worm was formerly held to be an unarmed variety of *T. solium*, but Küchenmeister and Leuckart have recently established its specific distinctness both by observation and experiment. It has a general resemblance to, but is larger and firmer in texture than, *T. solium;* not only does the whole band (Strobila, Fig. 36) commonly attain a

Fig. 36.

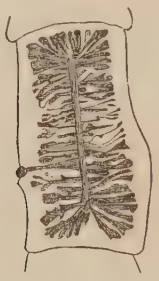


Tænia medio-canellata, natural size. (Davaine.)

greater length, but the segments are more numerous, and larger in all their dimensions. The unripe ones are broader than long, the ripe ones longer than broad. The contained uterus (Fig. 37) is more finely divided than in *T. solium*, having from 20 to 35 branches on each side. The common sexual aperture is placed alternately on either border, nearer to the posterior margin than in *T. solium*. The head is large (Fig. 38), measuring about $\frac{1}{75}$ in. (Davaine); has neither rostellum nor coronet of hooks: is furnished with four very powerful and prominent suckers; and, according to Leuckart, a fifth smaller

one in the usual position of the rostellum (Fig. 42). Küchenmeister also figures a central canal connected with the water-vascular system.

Fig. 37.



Ripe joint of *T. medio-canellata.* (Leuckart.

The eggs (Fig. 39) resemble those of *T. solium*, except that they are more oval in outline: they measure about $\frac{1}{70}$ in. by $\frac{1}{350}$ in.

Fig. 38

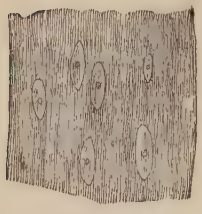
Head of *T. medio-canellata*, magnified. (Davaine.)

Fig. 39.

Ovum of *T. medio-canellata.* (Davaine.)

The larval form, or *Cysticercus tæniæ medio-canellatæ* (Figs. 40, 41, and 42), infests the flesh and organs of the ox, a fact which at once points out the chief difference between its life history and that of *T. solium*. *T. medio-canellata* abounds in Abyssinia and South Africa, and is also common in Europe: it was, until the recent researches of Dr. Cobbold, thought to be more common in Continental States than in this country; but it is now known to occur almost, if not quite, as frequently amongst us as *T. solium* does.

Fig. 40.



Cysticercus T. medio-canellatæ, natural size and position. (Leuckart.)

Fig. 41.

Cysticercus T. medio-canellatæ. Head everted. Magnified. (Leuckart.)

Notwithstanding its being unarmed, the great strength of its suckers enables the head to hold on with even greater tenacity than the *T. solium*, so that it is more difficult to expel, and it is believed to excite more marked symptoms; but as the larval form does not, so far as is at present known, infest man, it is less dangerous to life.

Fig. 42.

Head of *Cysticercus T. medio-canellatæ*, more highly magnified, showing central sucker. (Leuckart.)

The terminal joints separate spontaneously from the parent chain, and often creep out of the anus irrespective of the passage of feces; as a rule having first permitted at least a portion of their contained ova to escape by rupture into the intestine.

So far as is at present known, its treatment is the same as that for *T. solium*, and its prevention consists in the avoidance of raw or underdone beef.

The three following *Tæniæ* are placed by Leuckart in a separate group, of which the larvæ are distinguished by having comparatively small caudal vesicles, and are met with only in cold-blooded, generally invertebrate animals. Those occurring in man are minute, and have been so rarely met with, at least in Europe, as to be of comparatively little clinical importance.

TÆNIA NANA (Von Siebold)

Is scarcely an inch long, and about $\frac{1}{25}$ in. wide at its broadest part. Head globu-

far, with an oval rostellum bearing a single row of 22 to 24 very minute hooks, and four rounded suckers. Eggs globular, $\frac{1}{6}\frac{1}{4}\frac{1}{0}$ in. Found by Bilharz in great numbers in the duodenum of natives of Egypt. Its migrations and metamorphoses are unknown.

Tænia flavo-Punctata (Weinland).

The adult attains a foot in length. The joints of the anterior half of the chain are marked by a distinct yellow spot, the receptaculum semini, which is absent in the following segments. Head unknown. The egg measures $\frac{1}{4}\frac{1}{2}\frac{1}{5}$ in. Met with but once in a healthy infant in North America. Life history unknown.

Tænia elliptica (Batsch).

The adult worm attains a length of 6 in. to 8 in., head very minute, measuring $\frac{1}{8}\frac{1}{0}$ in., rostellum cylindrical, furnished with three or four rows of hooklets. Terminal segments three or four times as long as broad. Sexual apertures double, one on each margin of segment. Eggs measure $\frac{1}{5}\frac{1}{0}\frac{1}{0}$ in. It infests normally the intestine of the cat, and only very exceptionally has been found in man. Its life history is unknown.

Here I venture to add an abstract of a case (*Med. Times and Gazette*, p. 598, 1856) which suggests the possible addition of still another species of *Tænia* to the above list. A girl aged nine years, suffering from disordered digestion and impaired nutrition, passed with the feces for more than fifteen months consecutively numerous oval ova (Fig. 43), measuring about $\frac{1}{5}\frac{1}{0}\frac{1}{0}$ in. by $\frac{1}{5}\frac{1}{0}\frac{1}{0}$ in. and containing a globular embryo, furnished with three pairs of hooklets. These eggs differed so

Fig. 43.

Ovum of *Tænia* of uncertain species.

much from those of any other tape-worm then known to me, that I referred them to an undescribed species of *Tænia;* but whether this may ultimately prove to be correct or not, the view receives some support from the fact, that although the girl during the whole of that time was under observation as a hospital patient, was treated vigorously and repeatedly with male fern, kousso, pomegranate bark, turpentine, and various cathartics, and the stools carefully watched, yet no tape-worm joints were ever found, although the ova continued to be expelled in undiminished numbers. It is very difficult to suppose that the child harbored a *T. medio-canellatæ* which, although sexually mature, passed no joints, yet this is the only *Tænia* known to me of which the ova have even a passing resemblance to those found in this case. It seems more probable that the tape-worm was one which normally expels its ova without casting off joints of such dimensions, or in such a condition, as to be recognizable in the stools on a careful search.

In this case the functional disorder subsided shortly after treatment began, but as the ova continued to escape, it could not have been caused by the parasite or parasites. Ultimately the patient ceased to attend, but to the last her feces contained the same ova.

The two remaining tape-worms of man belong to the family *Bothriocephalidæ*, of which the adult forms infest chiefly cold-blooded vertebrate animals.

Bothriocephalus latus (Bremser).

Description.—This is the largest tape-worm known to inhabit man; it commonly reaches a length of 17 to 26 feet, and sometimes 60 feet or more (Fig. 44). The head (Fig. 45) is unarmed, oblong, or club-shaped, it measures $\frac{1}{1}\frac{1}{0}$ in. in length by $\frac{1}{2}\frac{1}{0}$ in. in breadth, has a deeply-grooved longitudinal sucker on each side, and passes gradually into a short thread-like neck. The joints are broader than long, the widest being $\frac{1}{4}$ in. in length, by $\frac{1}{2}$ in., or even more, in breadth; towards the posterior end of the chain they increase in length and diminish in breadth, assuming thus a more square form; they are thicker in the middle than at their margins, from the presence there of the sexual organs, which form a rosette-shaped patch in the centre of which the sexual apertures are placed. The eggs (Fig. 46) are oval, $\frac{1}{3}\frac{1}{7}\frac{1}{0}$ in. by $\frac{1}{5}\frac{1}{7}\frac{1}{0}$ in.; have a firm, brownish, structureless shell, with an operculum at one end. While yet within the uterus they present no trace of embryo in their interior.

Life History.—The ova escape by rupture of the ripe joints, and probably in part also through the oviduct, into the intestine before the joints separate; these are expelled with the stools at rather long intervals; not singly, as is often the case with *T. solium* and *T. mediocanellata*, but in short chains of 2 to 4 ft. in length. The ovum after a prolonged sojourn in water develops a ciliated embryo, which escapes through the aperture in the shell by forcing open the lid, and is furnished with three pairs of hooklets. On analogi-

cal grounds it is very probable that it then enters into the body of some aquatic animal, possibly a fish, but probably a mollusk, and then assumes the larval form, which is at present unknown. The intermediate bearer is probably eaten by

Fig. 44.

Bothriocephalus latus, natural size. (Davaine.)

Fig. 45.

Head of *Bothriocephalus latus*, magnified (Davaine).

Fig. 46.

a

Ova of *Bothriocephalus latus*: *a*, with contained yolk: *b*, empty shell. (Leuckart.)

man, and the larva assumes the adult form in his intestine. *B. latus* usually occurs several together; it has a somewhat limited geographical distribution, not having been found beyond the limits of Europe; in some countries of which only is it indigenous. It is common in the western cantons of Switzerland, Northwestern Russia, Sweden, Poland, Holland, Belgium, and Eastern Prussia; it is less often met with in other parts of Germany, and has occasionally been imported into Britain. Low-lying damp regions near the borders of seas and lakes are those in which it is most often abundant. It is found in persons of all ages and sexes, and in those countries where it is most frequent even children at the breast are not free from it.

The *Symptoms* do not differ from those caused by the species of *Tæniæ*. Its presence may be detected by an examination of the stools. It may be expelled by the same drugs as are employed in the treatment of other tape-worms, and it is said to be less difficult to dislodge, perhaps on account of the feeble development of its suckers. No precise knowledge has yet been attained of the measures to be taken to avoid it, but the general rule of carefully cooking all foods and of drinking only pure water would be likely to succeed even in those countries where it most abounds.

Bothriocephalus cordatus. (Leuckart).

A recently discovered, much smaller worm, found only in North Greenland in men and dogs. It is known by its caudate head and the absence of a neck.

Order *NEMATODA*.

Elongated, slender, often thread-like worms, not distinctly jointed, or provided with appendages; with a separated alimentary canal, a terminal mouth, an anus (*Gordius* excepted) near the caudal extremity, opening on the ventral aspect. The integument is marked by two lateral longitudinal bands, and often by a dorsal and a ventral one; in the former are imbedded the nerves with their ganglia, and the excretory tubes, which open in the surface about the level of the pharynx. The female aperture is placed near the central region of the body, that of the male near the anus, and conjoined with it; it is furnished with retractile spiculæ, usually two or more. The male is smaller than the female. The development is direct and the metamorphosis inconspicuous; so that the embryo has the general aspect of a nematode worm. The order is rich in species, and furnishes as many parasites as all the other Helminthoids put together. They infest invertebrata as well as vertebrata, and no organs escape their invasion.

Ascaris lumbricoides (Linnæus). Common round-worm.

Description.—A large nematode worm, during life of a reddish or brownish tinge, and of a firm, elastic texture (Fig. 47). The female reaches 15 in. in length by $\frac{1}{4}$ in. to $\frac{1}{4}$ in. in breadth; and the male 10 in. by $\frac{1}{8}$ in. (Leuckart).[1] The cylindrical body, covered by a cuticular layer and marked by fine transverse rugæ, tapers towards both ends, but more rapidly towards the head; in which is placed the

[1] These measurements exceed those given by Davaine.

terminal mouth, surrounded by three nearly equal prominent muscular and tactile lips (Fig. 48), each nearly as high

Fig. 47.

Adult female, *Ascaris lumbricoides*, natural size. (Leuckart.)

Fig. 48.

Head of *Ascaris lumbricoides*, magnified. (Davaine.)

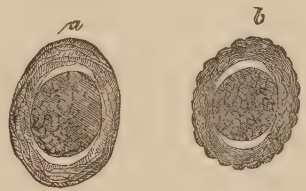
Fig. 49.

Caudal extremity of male *A. lumbricoides* magnified. (Leuckart.)

as broad, and marked off at its base by a distinct groove. The inner surface of each lip is beset with about two hundred very minute microscopic teeth. The triangular mouth conducts to a muscular œsophagus, and this to a simple, almost straight intestine, without distinction of stomach. The lateral longitudinal bands, much more distinct than the median, divide the muscular mass into nearly equal areas, and give attachment to their fibres, as well as support the nerves and excretory tubes. The caudal extremity, short and conical, terminates in a point, and in the male curves strongly towards the ventral aspect, on which is seen the cloacal aperture with two often projecting spiculæ (Fig. 49). These are connected with a short, ejaculatory duct, which is continuous with a seminal vesicle, and a single long, tortuous, tubular testis; the whole male generative organ forming a tube eight times the length of the animal. The vulva in adult females opens about the junction of the anterior and middle third of the body, it conducts to a short vagina, this to a uterus, which soon divides into two long horns, directed backwards; each of these leads to a short oviduct, which serves also as a receptaculum seminis, and thence to a very long, tortuous, tapering ovary. The female generative tubes are eleven times the length of the adult animal.

The ova are oval in form, and have a thick, firm, elastic, brownish shell, the surface of which is generally nodulated. No commencement of development is seen in their interior when deposited. They measure $\frac{1}{340}$ in. by $\frac{1}{440}$ in. (Fig. 50, *a* and *b*).

Fig. 50.



Ova of *A. lumbricoides*, from the stools: *a*, recently deposited; *b*, longer delayed in the stools. Shell tuberculated.

Life History.—So fertile is the round worm, that, at a moderate calculation, its yearly production of ova may be taken at 60,000,000, so that over 160,000 are daily discharged into the intestine of its bearer by one adult female worm. As, however, several are often present together, it is easy to understand that the stools of an infested person are so thickly strewn with the eggs as to make their discovery by the microscope an easy matter.

Although the migrations of the embryo of *Ascaris lumbricoides*, and the true history of its development, are not yet ascertained with sufficient exactitude, the

labors of Schubert, Verloren, Davaine, Leuckart, and others, permit the following history to be given as an approximately correct statement of the facts. The ova deposited with the feces very slowly develop an embryo in damp earth or water. The process may be complete in a month if artificial warmth be applied, but in nature it usually requires from five to eight months, and it may be delayed for a year or two by cold or dryness. Neither frost nor complete dessication, however, kills the embryo, and the contained ova of dried females develop under suitable conditions. The ova do not normally hatch in a free state; Davaine has preserved them in water for five years without any visible change in the embryo, or spontaneous escape from the shell. In this stage the embryo has the general aspect of a nematode worm, with an alimentary canal, a commencing generative system, and a terminal boring, embryonic tooth. The next stage of their development is not known. Davaine maintains that the ova with their contained embryos are swallowed with impure water, and develop directly into the adult form if received into the intestine of a suitable bearer. But direct experiments do not support this view; dogs, rabbits, oxen, pigs, and men have been fed with large numbers of the ova of *A. lumbricoides* containing living embryos without any infection resulting. Similar experiments conducted upon horses, dogs, and cats with the ova of their peculiar round-worms have had similar negative results, and it seems indeed almost certain that infection does not take place by a direct transference of the embryo-holding ova into the alimentary canal of the definitive bearer. It may be said also with some confidence that the embryos do not escape from the ova to enjoy a free existence for a time. On analogical and other grounds it is a far more probable view that the ovum is taken up in some way by an invertebrate intermediate bearer, perhaps a worm, or the larva of an insect, and in it the embryo passes through a necessary portion of its metamorphosis, and then enters the stomach of its future host in some passive mode with food or drink.

Ascaris lumbricoides infests also the pig[1] and the ox: it is found in man all over the known world, but more abundantly in some countries than in others. In the Southern States of North America, especially among the negroes, it attacks almost every one, young and old. In the West India Islands, Brazil, Finland, Greenland, in parts of Holland, Germany, and France, it is also very frequently met with. The rural population suffer more than the dwellers in towns, and the inhabitants of low and damp localities more than those who enjoy higher and dryer abodes. The poor, the young—excluding infants at the breast—the insane, and the dirty, are peculiarly liable to be infested. In certain regions it has occasionally prevailed so much for a time as to produce a kind of endemic malady.

The round-worm normally inhabits the small intestine, and there is some ground for the opinion that, unless a reinfection occurs, it escapes after some months. There can, however, be no doubt that it spontaneously wanders towards the external apertures under certain conditions which are not well known, sometimes passing through the anus, the mouth, the nose, often with severe purging, vomiting, or sneezing. After death, also, this migration is not uncommon, and is probably induced by a deficiency of food, or the presence of some conditions unsuitable for the welfare of the worm; but whatever induces it, it results in placing the worm occasionally in remote and singular localities, both during the lifetime and after the death of the sufferer. It creeps sometimes into the gall duct, gall bladder, or hepatic duct, more rarely into the pancreatic duct, and may give rise there to serious structural changes: it passes sometimes through an ulcer or other abnormal opening in the intestinal wall, and then is found after death in the peritoneal cavity, accompanied or not with the signs of peritonitis, according as it may have migrated during life or after death; it escapes sometimes with other intestinal contents from abscesses or fistulæ in the abdominal walls, and appears, indeed, in some such instances to have caused the local disease. It has so marked a tendency to creep into small apertures, that several instances are recorded of its becoming fixed in the eyes of buttons and other similar small rings which had been swallowed by the patient, and this habit has even suggested the swallowing of such rings to act as worm traps. This migratory instinct has occasionally led the round-worm along fistulous channels to still more remote cavities or organs; for example, to the pleural sac, the spleen, the kidney, the bladder, the muscles of the loin or neck, the spinal cord, the lung, the glottis, the trachea, and the Eustachian tube.

In the more favored countries, usually from one to five worms are met with together, but often many more are present; cases are recorded in which various numbers, from 200 to 2500, have been expelled from one person within a few months, and 1000 were found present together in the intestine of an idiot by Cruveilhier.

Symptoms.—The round-worm is one of the most frequently met with, and is clin-

[1] Leuckart considers this species identical with *A. Suilla.*

ically more important than any other human intestinal worm. When it is present in moderate numbers, and occupies its normal position in the small intestines in a person otherwise healthy, there are often no discoverable disorders of structure or function. When present in greater numbers or infesting a delicate person, it is accompanied by the symptoms of irritation of the lining membrane of the alimentary canal, and by consequent impaired nutrition and reflex phenomena. Thus it may be attended with pain in the abdomen, especially in the umbilical region, nausea, impaired or variable appetite, mucous stools, and tumid abdomen. Sometimes, also, pallor on the surface, dilated pupils, swollen eyelids, squinting, irritation of the nostrils, grinding of the teeth during sleep, &c.: indeed, all the allied symptoms which have been attributed to tape-worm. But these are by no means constant effects of the presence of round-worms in the intestine, nor are they peculiar to their irritation. They may be absent when worms are present in considerable numbers; and may be present when no worms infest the patient; or present with the worms but not caused by them. They have, therefore, little or no diagnostic value. Sometimes, however, especially when the intestine contained these worms in very large numbers, they have caused grave local irritation as well as constitutional disturbance, and then post-mortem examination has shown evidences of local superficial congestions and inflammation so closely related to them in extent or position, as to leave no doubt of their causal relation. Thus cases are recorded where numerous round-worms, cohering to each other, gave rise to fatal obstruction and inflammation of the intestines, and others in which they have excited serious and even fatal convulsions in susceptible persons. Although in these latter cases the reflex symptoms are probably in no essential point different from those caused by other irritations, it is important to trace them to the worms, if it can be done, because of the comparative facility with which the exciting cause can be removed. In the rarer cases in which the round-worm wanders during life into distant cavities, organs, or passages, the disorders they induce vary with the parts visited, and may be of great severity, or even terminate fatally.

Diagnosis.—When, for any reason, a patient is suspected to harbor round-worms, it has been a not unfrequent practice to employ the usual treatment for their expulsion—often a rather vigorous one—as a means of diagnosis; and should no worms be passed, it has been assumed that none were present: thus submitting the patient to treatment before the need for it is made out, and assuming, somewhat hastily, that the recognized treatment may be relied upon.

An easy and satisfactory method of diagnosis consists in the microscopic examination of the stools, in which, if the suspected person harbors a mature female, the ova[1] are readily seen. I published a case in the *Medical Times and Gazette* for June 14th, 1856, which so well illustrates the value of this method for diagnosis, and its bearing on treatment, that I venture to give here the following summary of it:—

A girl, aged twelve years, had passed two round-worms before she came under observation, and had complained for six weeks of abdominal pains and disordered digestion. For convenience of observation she was admitted into hospital Feb. 14th, 1855; her stools then contained ova of *Ascaris lumbricoides* (Fig. 50). After nine days, during which she was treated by a mixture of bicarbonate of soda and infusion of quassia, with rest and good diet, she declared herself well, but had passed no worms. For ten days more she was treated by oil of male fern and castor oil, followed by scammony, without effect. For a further period of ten days she took infusions of quassia and senna, also without result. For five weeks more she was given turpentine and castor oil, or turpentine alone, at weekly intervals; and about the third or fourth day after each dose, except the last, she passed one or two worms, generally but not always, motionless. The ova were still abundant in the stools, but the treatment failing to expel any more worms, she was given *Dolichos pruriens* for four days, until it caused nausea, when it was omitted; but for twelve days more she expelled occasionally one or two worms with the stools. The *Dolichos pruriens* was then repeated for eight days, and again omitted: after which she passed, in the following fortnight, three more worms. The ova were then found to be absent from the stools, and she was discharged. While under treatment she passed, in all, seventeen round-worms; but during the last three months and a half she was in perfect health, and would have been discharged but for the observation of the ova in the feces.

Davaine drew attention to the value of this method of diagnosis in 1857 (*Comptes Rendus Soc. Biologie*, 2e Série, t, iv. p. 188); and Leuckart says (*Die menschlichen Parisiten*, &c., B. ii. p. 251, 1867),

[1] It is curious to note that these ova have been described as cholera corpuscles (Lancet, 1849, p. 532); and more recently as "cholera phyton," in the Dutsche Klinik, 1867.

"In the microscopic examination of the feces we possess a means to determine the presence of the round-worm, which is as easy as it is sure; if it were more generally practised, many errors of diagnosis, and many useless, if not injurious treatments, would be avoided."

The *Etiology* and *Pathology* of the disorders induced by round-worm have appeared on the surface during the previous observations.

Treatment.—The indications are to relieve the irritation of the alimentary canal, to improve the general nutrition where that has suffered, but above all things to expel the worms. Many of the substances which have obtained a reputation as anthelmintics have been much used for round-worm, but we have as yet no sufficiently exact knowledge of their action upon the different species of intestinal worms to enable us to estimate their true clinical value in the treatment of *Acaris lumbricoides*. There exists, however, a very general concurrence of opinion, which I believe to be well founded, in favor of the use of santonica or worm-seed, the unexpanded flower-head of an undetermined species of *Artemisia* as well as of its active principle, santonin. The dose of the worm-seed is from 60 to 120 grains, but it is not much used on account of its inconvenient form; that of santonin, which is more used, is from one to three grains twice daily to a child, and from three to six grains for an adult. After a short course of this medicine, an aperient may be given with advantage. It is apt to produce a singular although but temporary perversion of vision if given in too large doses, or for too long a time, objects seeming to be yellow, blue, or green. The urine also may be tinged red after its use. Violent cathartics do not deserve much confidence, nor are the drugs employed for tape-worm (except, perhaps, turpentine) to be trusted to. *Dolichos pruriens* would seem to be worthy of further trial in some cases where santonin is not available, but of the numerous other substances which have been at times recommended for the treatment of *A. lumbricoides*, it is unnecessary to say more here.

The *Prevention* of *Ascaris lumbricoides* cannot be so confidently treated of as was that of *T. solium*, because we are not certain how it enters our bodies; but whether we hold with Leuckart that an intermediate bearer is essential, or with Davaine that it is not, and that we drink the ova in impure water, in all probability the careful cooking of all our foods and drinks would prove a good protection even in those countries and districts in which this pest most abounds. It is not, however, probable that well-filtered water could convey the infection.

Ascaris mystax (Zeder)

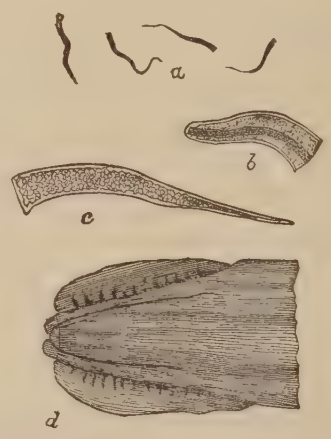
Is the common round-worm of the cat, and is identical with *Ascaris marginata* of the dog (Schneider).

Description.—It is smaller and more slender than *A. lumbricoides*, has two small lateral, cuticular, wing-like appendages near the head. The vulva in the adult female occurs about one-fourth of the whole length from the head. In man it has only been found parasitic in three trustworthy instances, which are recorded by Bellingham, Cobbold, and Leuckart.

Oxyuris vermicularis (Bremsen) (Common seat-worm).

Description.—A small whitish fusiform worm, the female attaining $\frac{4}{10}$ in. in length by $\frac{1}{40}$ in. in thickness, and the male about $\frac{1}{8}$ in. in length by $\frac{1}{180}$ in. in

Fig. 51.



Oxyuris vermicularis. *a*, Natural size. *b*, Head, magnified. *c*, Tail, magnified. *d*, Head, more magnified. (Davaine.)

thickness (Fig. 51). The head (Fig. 51, *b*, *d*) is furnished with three inconspicuous lips around a terminal mouth, and an elongated vesicular expansion of the cuticular layer on its dorsal and ventral aspects. The œsophagus is continuous, with a muscular stomach containing three teeth, and then follows a simple intestine. The surface is marked by fine transverse rugæ, and the lateral longitudinal bands form a slight angular projection. The female has a long, awl-shaped, caudal extremity (Fig. 51, *c*); the vulva is situated about the junction of the anterior and middle thirds of the body, and conducts to a vagina, a bifid uterus, and this to two tubular ovaries. The male has a blunted tail end furnished with six pairs

of papillæ, and a single spiculum communicating with the anal aperture. The eggs (Fig. 52) are oval but flattened on one surface, measure $\frac{1}{11\,0\,0}$ in. by $\frac{1}{2\,3\,0}$ in., contain at the time of deposition a developing embryo, and have a firm shell consisting of three layers, one of which is absent at one pole, so as to facilitate the escape of the embryo. A moderate estimate allows 10,000 to 12,000 ripe ova for the uterus of a single female.

Fig. 52.

Ovum of *Oxyuris vermicularis*, from the feces. (Leuckart.)

Life History.—The seat-worm, like the round-worm, is found all over the world, and is perhaps even more frequently met with. It is said to abound particularly in Egypt and in Greenland. It normally inhabits the colon of man only, especially in the neighborhood of the rectum, and is commonly found in large numbers, the males fewer than the females, and it often migrates spontaneously through the anus. The ova are discharged into the intestine of the infested person, and there undergo a further development, so that at the period of their escape with the stools they usually contain a distinctly formed embryo. The frequent spontaneous migrations of the ripe female also often lead to the deposition of the ova upon the skin and hair in the neighborhood of the anus.

The ova deposited with the stools rather rapidly develop under favorable conditions, especially moisture and the warmth of the sun; they are not killed by extreme cold or by desiccation, but a few days' delay in water kills them outright, and under ordinary circumstances they die in a few weeks unless their progress has been arrested by cold or dryness. It does not seem that they hatch in the free state.

Küchenmeister and Vix conceive that all the transformations from the embryo to the adult form take place within the intestine of the infested person without any necessary migration, and at first sight this view seems to receive support from the fact that large numbers of seat-worms are commonly found together, and that various grades of development are there met with. This view, however, is out of accord with the general law of development in parasitic animals, and does not suffice to explain the known facts. Leuckart insists that the emigration of the embryo is a necessary condition of its future development, and has indeed almost proved the correctness of this view by observation and experiment, as well as by powerful arguments. His view is, that the ova deposited with the feces are abundantly and widely scattered in the dry state by winds and other agencies, and then are taken into our stomachs upon uncooked fruits and vegetables, and in various other conceivable modes; there, exposed to the digestive fluids, the embryos escape, are carried down into the colon, and attain the adult form probably in about two weeks. A sort of self-infection frequently may take place also: in persons already infested, it is easy to see how the ova upon the skin and hairs near the anus may be conveyed to the mouth by the fingers, after scratching to allay the violent irritation which these small pests produce; and in other modes the eggs may find their way into the stomach from the soiled bed-clothes or personal linen. These views explain some long-known facts which are not otherwise so easily understood; for instance, the great length of time during which some persons suffer from seat-worms, and the liability to relapses notwithstanding repeated treatment: the frequency with which these worms are found inhabiting many members of one family or household, the greater liability of children, of dirty or insane people, and of persons who often eat uncooked fruit and vegetables, as well as the immunity of infants at the breast.

Symptoms.—When only a few seat-worms are present, they give rise to no inconvenience, and are usually only accidentally discovered in the stools. When they are more numerous or the patient is more sensitive, they cause an itching or tickling in the anus and its neighborhood, which is sometimes intolerable to the sufferer, especially at a certain hour in the evening. In females it is peculiarly distressing, from the habit which the worm has of wandering into the vagina; but in both sexes inordinate sexual excitement sometimes is produced. Although there is sometimes evidence of local irritation in the shape of excess of mucus in the feces and punctiform redness around the anus, the cases of severe convulsion and other nervous disorders which have been referred to the action of seat-worms must be received with much caution.

Diagnosis.—Inspection of the stools will discover the worms; and a microscopic examination will show the ova.

Treatment.—Probably any infected person who adopted the requisite precautions against reinfection from himself or others would get well in a few weeks without treatment by drugs,[1] but this period would

[1] This appears to be a daring statement in the face of past experience, but its probability is measured by the evidence for the life history here given.

be shortened by the use of aperients, and occasionally injections into the rectum of cold water, turpentine and castor-oil with gruel, and of preparations of wormwood, quassia, assafœtida, santonin, &c. Frequent external applications of mercurial or other ointments and lotions likely to kill the embryos might be employed also.

Prevention.—From the foregoing history, it may be learned that a sufferer from seat-worms should avoid touching the neighborhood of the anus, should be scrupulously clean[1] in person and in clothing; that persons not yet infested should avoid close personal contact, especially in bed, with those who harbor the worms, and should always adopt the caution of eating only well-cooked food.

Family STRONGYLIDES.

Dochmius duodenalis (Leuckart).

This minute but dangerous parasite was discovered by Dubini in 1838, in Northern Italy; its zoological position is scarcely yet settled, but its close affinity to the genus *Dochmius* of Dujardin has been shown by Molin and Leuckart.

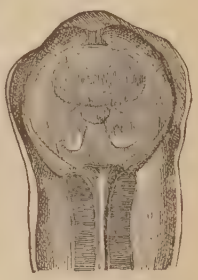
Description.—It is a small, somewhat cylindrical worm: the females measure $\frac{7}{10}$ in. and the males $\frac{4}{10}$ in. in length (Fig. 53). The terminal mouth is surrounded by a dilated capsule directed obliquely backwards and furnished with four large teeth on its longer or ventral border, and with four smaller ones on the opposite or dorsal margin (Fig. 54). The bursa of the male is complex, the spicula two in number. The vulva of the female is placed a little behind the centre. The eggs are oval, measure $\frac{1}{34}$ in. by $\frac{1}{70}$ in., and when deposited contain a yelk in process of cleavage.

We know as yet but a part of its life history by direct observation, and infer the remainder from that of the better known and very closely allied *D. trigonocephalus* of the dog. The egg, after escaping with the stools, under favorable conditions hatches in a few days, and the embryo enjoys a free existence for a time in mud and muddy water. It is taken into our stomachs by drinking impure water without the intervention of any intermediate bearer, and there it grows and develops to some extent before it passes on into the duodenum or jejunum, where the adult form is assumed. It then attaches itself by its powerfully armed mouth to the villi of the mucous membrane, and sucks the blood of its host. Sometimes, under conditions not yet explained, it becomes encysted between the mucous and muscular coats of the gut. It occurs in warm countries only, has been found in Italy (Dubini), Brazil

Fig. 53.

Male and female *Dochmius duodenalis*, magnified. (Leuckart.)

Fig. 54.



Head of *Dochmius duodenalis*, magnified, showing the armature of the mouth capsule. (Leuckart.)

(Wucherer), and in Egypt (Pruner, Bilharz, Griesinger), where it is a very frequent and dangerous pest, infesting about one-fourth of the entire population. It is present in large numbers together, often by hundreds, sometimes by thousands, and then may cause frequent and dangerous hemorrhages into the bowels, followed by an anæmic condition, which is often fatal, and to which the name of Egyptian chlorosis had been given before Griesinger pointed out its true nature.

Doubtless its ova might be found in the stools of infested persons but of the treatment which should follow a diagnosis so established little can be said, except that Griesinger recommends turpentine, and that santonin and such other substances as are believed to expel nematode worms should be tried. Care should also be taken to consume only pure water or drinks which have been boiled, so as to avoid re-infection, and the patient might then be fairly expected to outlive the worm.

Although to the practitioner in Britain this parasite is not of practical import, it seems so probable that it may be found in

[1] The common Hindoo custom of washing after every act of defecation is worthy of more frequent imitation in this country.

India or some of the tropical British colonies, that I have ventured to include it here.

[*Filariæ* have long been known to exist in the blood of dogs, &c., and one, Bilharzia hæmatobia, in human blood. In 1870, Dr. T. R. Lewis,[1] of the British Army, discovered a worm in chylous urine of patients in Calcutta. Examining the blood of a patient having diarrhœa, in 1872, he found a number of filariæ; and also in the urine in 15 to 20 cases of hæmaturia and chyluria.

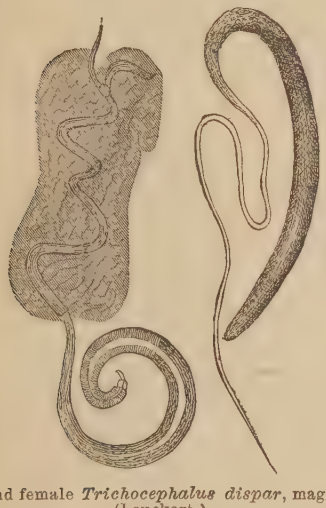
The average diameter of the Filaria Sanguinis Hominis is $\frac{1}{3\,5\,0\,0}$ inch one way, $\frac{1}{2\,5}$ inch the other. Estimated number, 140,000 in the body of one patient. They may apparently remain in the blood two years innocuously. Their life-history and transformations not yet ascertained.—H.]

Family TRICHOTRACHELIDES.

Trichocephalus dispar (Rudolphi).

Description. — The female measures about $\frac{1\,9}{1\,0}$ in., the male about $\frac{1\,6}{1\,0}$ in. in length. The anterior three-fifths of the body are threadlike, measuring $\frac{1}{1\,5\,0\,0}$ in. only in thickness, and bear a simple terminal mouth without papillæ. The posterior two-fifths, about $\frac{1}{2\,5}$ in. in thickness, contain the generative organs and the intestinal canal; in the male, it is spirally coiled, in the female slightly curved (Fig. 55). The caudal extremity is rounded off in the male, and bears a single blunt spiculum in a tubular protrusile sheath which is furnished with teeth. The vulva in the female opens about the level of the stomach into a vagina, the walls of which are furnished with teeth, and often prolapse. The large uterus contains thousands of eggs, which are elliptical in form, and have a nipple-shaped projection at each end. They measure $\frac{1}{2\,5\,0\,0}$ in. by $\frac{1}{1\,1\,2\,5}$ in. (Fig. 56), and have a firm brownish-yellow shell, wanting at each pole, so as to leave an aperture which is closed by a firm transparent nipple-shaped plug. As found in the stools the yelk shows no trace of commencing development.

Fig. 55.



Male and female *Trichocephalus dispar*, magnified. (Leuckart.)

Fig. 56.

Ovum of *T. dispar*.

Life History.—The *Trichocephalus crenatus* of the pig, and also that found in some monkeys, is probably the same as our *T. dispar*. It is met with in most, if not in all, European countries; in Syria, Egypt, and North America; it abounds in Italy, and in some Eastern lands; but is said to be comparatively rare in Copenhagen and in London (Cobbold). It does not generally occur in large numbers together, although sometimes hundreds have been found. The head of the colon is its chosen residence, but occasionally it is met with in the intestines near. During the life of its host, it attaches itself by thrusting its long whip-like neck into the mucous membrane. The ova deposited with the stools, like those of *Ascaris lumbricoides*, very slowly develop normally in damp earth or water, so that in warm weather and under favorable conditions the embryo is formed in about four or five months; but in cold weather or exposed to temporary drought it requires a year and a half or more. In this state the embryo remains, and neither develops further nor leaves the shell to become free. (Davaine has preserved them alive in this stage for four years.) From Leuckart's experiments upon the *Trichocephali* of sheep and pigs, it is highly probable that no intermediate bearer intervenes, but that we swallow the ova with their contained embryos in some accidental manner, as dust upon uncooked fruit, vegetables, &c. &c., and that the embryos escape into our stomachs after partial digestion of the shells, develop somewhat, and then travel onwards to the colon, where they become sexually mature in four or five weeks.

[1] Pamphlet, On a Hæmatozoon inhabiting Human Blood, &c., Calcutta, 1872. See also a report of cases by Dr. Able, N. Y. Med. Record, April 12, 1879.]

No symptoms are known to be caused by *T. dispar*, although some writers have attributed severe reflex disorders to them when present in large numbers.[1] The worm may be readily shown to be present by finding the ova in the stools. A satisfactory treatment by drugs is not yet known, but there is consolation in the reflection that the parasite has probably a short duration of life, and that we may prevent further infection by avoiding uncooked foods and drinking pure water.

[TRICHINA SPIRALIS.

By Henry Hartshorne, M.D.

This parasite belongs with the round or thread-like, *nematoid* worms; allied to, but generically distinct from *trichocephalus*. It was discovered by Tiedemann in 1822, and independently by Hilton in 1832. Owen, in 1835, described and classified it. Leuckart ascertained its characters in the mature condition; Zenker, Virchow, Herbst, Turner, Thudichum, Althaus, and Dalton are among those who have investigated its history.

When mature, the male is $\frac{1}{8}$ of an inch long; the female of at least twice this length. The eggs are about $\frac{1}{200}$ of an inch in diameter. Each female contains from three to five hundred ova. These, after fertilization and six or eight days of gestation, are developed into embryos; which, when extruded within the intestines of an animal, commence at once their migrations. Finding their way through the intestinal walls, they travel on, until they locate themselves in or between the fibres of some of the muscles. There they coil into a spiral form, and become gradually surrounded by a calcareous cyst. This has an ovoid or lemon-like shape, and is visible to the naked eye, as a whitish or gray speck. The muscular fibres of the part so inhabited undergo degeneration. In the dissecting-room, such altered muscles have not unfrequently been observed in this country as well as in Europe. The muscles most affected are differently stated by various authors; but any or all of the red striated muscles may be involved. For examination during life, the muscular tissue of the under part of the tongue is preferable. A fragment may be obtained by means of a small knife or *harpoon* (Middeldorpff). When this tissue is moistened, the free worms may be seen with a lens of moderate magnifying power. If encapsuled, a drop of chlorohydric acid will dissolve away the cyst, and show the coiled Trichina within it.

[Fig. 57.

Cysts of Trichina *in situ*, natural size.]

The hog is especially liable to Trichina, but it has been found also in the ox, horse, sheep, dog, cat, badger, hedgehog, mole, pigeon, and eel. Experimentally, by feeding animals upon infested meat, it has been communicated to the rat, mouse, rabbit, guinea-pig, and other creatures. Sometimes death follows this infestation, but it is astonishing how little disturbance

[1] When Röderer and Wagler, about a century ago, rediscovered this worm, Morgagni's prior observation having been forgotten, they supposed that it produced the typhoid fever then prevailing at Göttingen. It is not difficult to see how such an error arose, the worms having been found in the bodies of most of the victims of the fever, and nearly coinciding in seat with the local manifestations of the disease. In connection with this, it is noteworthy that the more modern theory of the etiology of typhoid fever receives an indirect support from the fact that every person who is shown to be infested with those very common Entozoa *Oxyuris vermicularis* or *Trichocephalus dispar* is thereby demonstrated to have swallowed minute portions of his own or another person's feces.

of health occurs, in a large number of instances. Stiffness of movement, and hoarseness of the voice, in a certain number of cases, show the affection in swine. Much more often, however, they appear to be, during life, in as good a condition as other animals not so inhabited. The number of the parasites

[Fig. 58.

Trichina cyst, magnified.]

[Fig. 59.

Trichina, magnified. *a.* Head; *b.* Tail; *c.* Body.]

in the muscles of an animal may be immense. As many as 10,000 to 18,000 have been found in a cubic inch of hog's flesh. Prof. Dalton[1] estimated the number of them in a human subject at 85,000 to the cubic inch. From 1,000,000 to 2,000,000 of them may exist in a single human body, according to examinations made in several cases.

It was not until 1860 that the morbid effects of this parasite, when inhabiting the body of man, were distinctly recognized. Zenker then found Trichinæ in ham and sausages eaten by those affected by them. Wunderlich saw two cases in Leipsic in 1862. Several persons died from this cause the same year at Plauen, in Saxony. In 1863 occurred the most startling example of it, at Hettstädt, in Prussia. Of 103 persons there dining together on a festive occasion, 20 died, and 80 others were for some time ill. A part of their dinner consisted of sausages, smoked and warmed, but not cooked. Some of the sausages left were examined, and found to be swarming with Trichinæ. The same was ascertained to be the case with the muscles of those who had eaten of them. Since that occurrence, a number of other instances of a similar kind have been reported in Germany. All of those so affected have eaten raw or but slightly cooked meat, mostly ham or sausage.

The first cases of Trichinosis recorded in America were seen by Dr. Schnetter, of New York, in 1864.[2] Near the same time, Dr. Voss, of the same city, saw four persons so affected, on a steamer from Bremen. Afterwards, cases were reported by Drs. Lothrop, of Buffalo, Wilson and Ristine, of Marion, Iowa, and others. A number of cases have occurred in Canada.

In Chicago, in 1865–6, a committee of physicians,[1] on examining more than a thousand hogs from different packing establishments, reported that 1 in 50 of those animals, received at Chicago, was trichinous. A year before, a similar investigation at Brunswick, Germany, showed that only about 1 in 10,000 hogs, in that locality, were so infested.

In 1878,[2] H. E. Atwood and Dr. W. T. Belfield, of Chicago, found 8 hogs in 100 to contain Trichinæ. About the same time, Prof. Heschl, of Vienna,[3] stated that, of American hams imported into North Germany, from 10 to 20 per cent. were trichinous; while the proportion in Westphalia hams was but 1 in 2000 or 2500. The Chicago observers last mentioned (Atwood and Belfield) did not find the worms in the hams, but in muscles of other parts of the animals. They also state that the infested hogs appeared to be in good health.

Moreover, having fed a rat with trichinous pork, Dr. Belfield ate a portion of the rat's flesh, which had been ascertained by the microscope to contain twelve Trichinæ. At the end of more than a month, he had suffered no inconvenience. This confirms what has been established by many other observations, that *a few* Trichinæ may, even in man, be harmless inhabitants of the body; while, if they number, as is often the case, hundreds of thousands, disease, and very frequently death, will result.

The Symptoms of Trichinosis are recognizable in two groups or stages: those belonging to the period during which the worms are resident in, or have not fully escaped from, the intestinal canal, and those attending their later presence in the muscles. Altogether, their progress until encapsuled and stationary (unless in some manner disturbed) occupies three or four weeks. A trichinous patient may die within a month; if that time is survived, he is likely to recover, although not without delay and inconvenience.

In the first stage, general discomfort, weakness, indigestion, vomiting, and looseness of the bowels show that some cause of serious gastro-enteric irritation exists. This stage lasts usually about a week; then fever supervenes, not disappearing under free perspirations; with puffiness of the face, hoarseness, sometimes marked dyspnœa, difficulty in swal-

[1 Observations on Trichnia Spiralis. Transactions of N. Y. Academy of Medicine, vol. iii. 1864.]

[2 Dalton, op. citat.]

[1 Chicago Med. Examiner, April, 1866.]

[2 Report of Department of Health, Chicago, 1878. See also, Sanitarian, July, 1879, p. 324.]

[3 N. Y. Med. Record, Aug. 9, 1879, p. 135.]

lowing, pain on moving the eyeballs, tenderness of the abdomen, more or less diarrhœa, and—most characteristic of all—pain and rigidity in the muscles of the neck, back, arms, and legs. With continuance of the fever, exhaustion follows, and insomnia; in some cases delirium, with scantiness and high color of the urine. Intercurrent pneumonia is not rare. Death may happen in from three to five or six weeks, seldom later.

One of the best signs of improvement, promising convalescence, is a return of freedom in the secretion of urine. If, with this, fever abates, and the muscular distress is sufficiently lessened to allow sleep, recovery may be looked for.

It appears probable that a moderate number of these parasites may be present in a human body for a long time without producing serious illness. In 1873 a man died in Middlesex Hospital, London,[1] from phthisis, in whose muscles many Trichinæ were found. Some medical evidence obtained concerning his previous history made it appear that they may have been taken into his system two or more years before. Dr. E. Wendt, of New York,[2] has reported cases in which chronic rheumatismal symptoms were, in his judgment, best accounted for by Trichinosis. He suggests that possibly many obscure cases, supposed to be of chronic rheumatism, are really of such an origin.

Treatment.—If trichinous meat is known to have been eaten, the early use of emetics and purgatives is indicated. This is, however, seldom the case; mostly the entrance of the parasites into the system is not suspected until their progress has gone beyond the beneficial reach of such remedies. When the walls of the intestines have been already invaded, if not penetrated, and, still more, after the migratory Trichinæ have passed to the muscles, their preferred *habitat*, no method of dislodging them has been devised. Nor, indeed, does it seem likely that any treatment will avail much after this period. Traube[1] is said to have obtained recoveries under frictions of the body and limbs with salt. Carbolic acid (Tavernier), benzine (Mosler), nitro-picric acid (Friedreich), ether with oil of turpentine (Küchenmeister), and other medicines have been tentatively given. It is doubtful whether any of them has cured cases which would not otherwise have recovered.

According to Hœberlein, salicylic acid destroys Trichinæ when it is sprinkled over infested muscles in the dead body. It may, reasonably, be added to the list of medicines to be tried against this *opprobrium* of therapeutics. Hot baths, the wet pack, and massage, with hypodermic injections of morphia at night, would seem to be the most promising of palliative measures, promoting convalescence in those not exhausted by the malady.

Prophylaxis.—This is, happily, simple, clear, and certain. It has been shown by Perroncito, of Turin, that a temperature of 122° Fahr. will destroy the vitality of Trichinæ, as well as of the cysticerci, strongylus, filariæ, etc. Fiedler asserts that *encapsuled* Trichinæ require a heat approaching 150° to 160° Fahr. to kill them. Never, however, will they survive *thorough cooking* of the flesh in which they exist, either free or in their cysts. It is not enough to cook them slightly. Nor will cold smoking, even when protracted, be sure to destroy them. Hot smoking, thoroughly done, may suffice; but it is best not to trust to it. The reason why Trichinosis is frequent in Germany, and rare in the United States, is, that eating raw meat or sausage is tolerably common in the former, while in America meat is almost invariably cooked before it is eaten.

Practically, then, our precept must be, that no pork, ham, or sausage should be eaten without being *well cooked*, through and through. Provision dealers and sanitary authorities, also, owe it to the public as well as to themselves, to organize and insist upon more complete inspection and selection of animals to be slaughtered; the alternative being that the public feeling, once fairly alarmed by the fatality of Trichinosis, may bring about a general abandonment of porcine food.—H.]

[1 Lancet, Jan. 17, 1874.]

[2 Am. Journal of Med. Sciences, April, 1878; and N. Y. Med. Record, October 4, 1879.]

[1 Lancet, July 8, 1871.]

DISEASES OF THE DIGESTIVE SYSTEM.—*Continued.*

E. DISEASES OF THE PERITONEUM.

1. Peritonitis.
2. Tubercle of the Peritoneum.
3. Carcinoma of the Peritoneum.
4. Affections of the Abdominal Lymphatic Glands.
5. Ascites.

PERITONITIS.

By John Richard Wardell, M.D., F.R.C.P.

Definition.—An inflammation of the serous membrane which invests the abdominal organs and lines the abdominal cavity. It may be partial or limited, or it may be diffused over the entire inner surface of the peritoneal sac. Effusion is almost the invariable consequence, and examination after death discovers serum, albuminous exudation, sero-purulent, purulent, or sero-sanguineous fluid and organized adhesions.

Preliminary Observations.—Inflammation of the peritoneum is characterized by the kind of phenomena which are exemplified in the inflammation of the other serous membranes. It may occur at all ages, in every description of temperament, and under the most varied conditions of the system. It attacks the earliest infancy as well as the adult and those in advanced life, and both sexes are equally liable to the affection. It happens to the robust and plethoric, the cachectic and attenuated, and also to those whose constitution has been undermined and broken down; and whenever its distinguishing symptoms are really proclaimed it is one of the most formidable maladies with which the physician has to deal. It may come on suddenly with apparent and easily recognized symptoms, or it may supervene slowly and insidiously, and continue for a time without being detected. It may be primary when it is difficult or absolutely incapable of connection with any foregoing or coëtaneous disease. It may be consecutive upon, or symptomatic of, some other morbid condition. It may present the sthenic or asthenic form. And it may be met with only in sporadic cases, or prevail as an epidemic. Every example of the complaint will, if carefully studied, exhibit some peculiarity—some cognizable difference in its physiognomy, if such term may be employed—dependent upon the degree of mal-nutrition, or the metamorphosis of the tissues, upon the operation of external agencies, the time of life, the amount of vital power, and the idiosyncrasies of the patient. It will be modified by the state of the depurative organs, and especially by that of the kidneys, because those deleterious and effete matters which ought to be carried off by the renal organs, when retained in the circulation, are particularly prone to institute the inflammatory process in serous membranes. When the disease is regarded in all its phases and its cardinal signs are duly observed, it exhibits a train of phenomena peculiar to its own morbid action; and if Peritonitis, like pneumonia and certain other diseases, which formerly had always accorded to them an essentiality, is not to be deemed an essential complaint—a nosological entity, as some modern pathologists maintain—it certainly from its importance demands a distinct place in a comprehensive work like that of "The System of Medicine."

The older authors did not distinguish the inflammation of this membrane as apart and disconnected, but only as associated and confounded with the inflamed condition of subjacent organs and tissues, nor was it until the close of the last century that this distinction was made. Since that time the researches of Broussais, Bichat, Barron, Hodgkin, and more

recently of Habershon, have extended our information, and given much precision to our knowledge on the subject. Sauvages remarks: *Enteritis mesenterica* (Peritonitis) *difficillime distinguitur ab enteritide, quacum etiam sæpe complicatur.*"[1] Cullen says it is difficult to say by what symptoms it can be recognized, and more recent authors have expressed themselves in similar language: but, as will hereafter be shown, it unquestionably displays features by which it can be diagnosticated. John Hunter thus delivers himself on this subject: "If the peritoneum which lines the cavity of the abdomen inflames, its inflammation does not affect the parietes of the abdomen; or if the peritoneum covering any of the viscera is inflamed, it does not affect the viscera. Thus the peritoneum shall be universally inflamed, as in puerperal fever, yet the parietes of the abdomen and the proper coats of the intestines shall not be affected."[2] That these propositions are sometimes verified it cannot be denied, but according to my own experience in Peritonitis which has existed for a time, it well-nigh always happens that some of the organs and structures which it covers reveal the inflammatory products. Dr. Habershon, in a valuable article[3] on the etiology and treatment of Peritonitis, speaks with much boldness and decision on this question, and he bases his conclusions on the trustworthy grounds of accumulated facts. "In 3752 inspections recorded at Guy's Hospital," says this physician, "during twenty-five years 500 instances of Peritonitis occur, but we cannot find a single case thoroughly detailed where the disease could be correctly regarded as existing solely in the peritoneal serous membrane." He then divides them, first, into Peritonitis by extension from diseased viscera or direct injury; secondly, into those connected with blood changes, as in albuminuria, pyæmia, puerperal fever, and erysipelas; and thirdly, into those caused by nutritive change, as in struma and cancer. This author then contemplates the affection, so-called Peritonitis, as nothing more than the local evidence of antecedent morbid changes pervading the whole system. Dr. Sieveking says it is the climax of nutritive derangements, certainly not to be sought for primarily, in the serous investment of the intestines.[4] The former of these authorities denies that it is *ever* idiopathic, but he would almost seem to discard that term from pathological phraseology, as he conceives it can hardly with correctness be applied to any disease spontaneously instituted within the organism, and not dependent upon external noxious agencies or parasites.

Sometimes the lesion is but partial, in other instances it extends over the entire membrane, and doubtless it is at the outset only that it is limited, and that its diffusion gradually supervenes. Its closest analogies are pleuritis and pericarditis, and like these affections it is broadly distinguished by its tendency to effusion, adhesions by coagulable lymph, or the deposition of purulent or sero-purulent fluid. The pathologic conditions consequent upon Peritonitis, as of the other maladies now instanced, are sometimes inceptive of further disease, or they may be defensive against worst results;[1] they may eventuate in the union or binding down of organs and parts whereby their functions are seriously or even fatally interfered with; or this same tendency to albuminous exudation may, as in some instances of perforation, be conservative of life, the plastic deposit being the means whereby nature essays to effect reparation. But these and kindred considerations will be more fully considered when I speak of the pathology and morbid anatomy of the disease.

ETIOLOGY.—The causes of Peritonitis are often traceable to wet and cold, damp feet, damp beds, chill winds, sudden alternations of temperature, as when, after being in a heated atmosphere, the body is rapidly cooled, or to excessive fatigue—in fact to such general influences as are concerned in the production of inflammation in other viscera. It may, in a more direct manner, be induced—in a mechanical way—by invagination, strangulated hernia, surgical operations (as in paracentesis abdominis, and ovariotomy); by contusions, bruises, the wounds of cutting or blunt instruments; by displacement of some of the internal organs, or some unusual stretching or laceration of the membrane;—by the extrusion of certain matters into the serous sac, as in hepatic or splenic abscess, rupture of the stomach, bile-ducts, spleen, uterus, urinary bladder, ureters, the ovary or some part of the subdiaphragmatic digestive tube. It may follow or be associated with the acute disease of some organ by contiguity of structure, as in gastritis, hepatitis, splenitis, in dysentery, or in typhoid fever when the lower third of the ileum or the vermiform appendix is ulcerated. Sometimes tumors, extra-uterine conceptions, or malignant growths by the induction of pressure, or ulcerative absorption, give rise to it. The abrupt suppression of habitual

[1] Classis iii. gen. xv. sp. iv.
[2] On the Blood, p. 244.
[3] Medico-Chirurgical Review, No. xliii.
[4] Croonian Lectures, British Medical Journal, April 14, 1866.

[1] Sir Thomas Watson.

discharges, more especially of the catamenia and lochia, and the sudden retrocession of cutaneous eruptions, have been enumerated; and contamination of the blood itself, resulting from the altered and imperfect action of certain of the excreting organs, enters, there are good grounds for believing, far more frequently and far more importantly as an element in the causation than has hitherto been supposed. Indeed, many attacks which we regard as idiopathic are dependent upon a common cause in the organism, but this membrane may sometimes have a greater proclivity to the condition of inflammation than any other part. Sometimes Peritonitis is metastatic of rheumatism, erysipelas, and the exanthematous fevers. Broussais repeatedly knew it to succeed intermittent fever, and it is occasionally connected with fevers of a malignant type.

SYMPTOMATOLOGY.—The invasion is often sudden, but the attack may come on slowly and covertly. In the acute sthenic form there are generally rigors, followed by heat and flushings, a feeling of lassitude, aching of the limbs, head, or back, a sense of constriction and uneasiness at the epigastrium, thirst, nausea, and acute pains at some, especially the lower, part of the belly. Pressure on the abdomen, coughing, sneezing, the evacuation of the bladder or bowels, or even the erect position, augments the pain; indeed whatever produces weight upon or stretches the membrane, of necessity aggravates the suffering. The pain is at first localized, but it soon becomes diffused over the entire abdomen, and is a prominent sign. As the disease progresses, the pulse becomes quick, hard, sharp, and tense, and rises from 120 to 130 in the minute. In some exceptional cases it does not ascend to more than 80 or 90, and is of tolerably full volume; but as the rule it is firm, small, and cordy. The pulse is not always, however, a sure guide, as most serious attacks may be progressing under all conditions of the arterial circulation; and even pain on pressure, the most trustworthy of all individual symptoms, is not invariably to be relied upon, because it is not uniformly commensurate with the amount of lesion which really obtains. The tongue is mostly moist and covered with a whitish creamy mucus, but occasionally it is dry. The bowels have a tendency to be confined, and the urine is scanty and high-colored. The skin is hot and dry at the earlier period of the disease, and becomes cool and bedewed with a clammy sweat before dissolution. The patient lies in the supine posture with knees drawn up, and cannot turn on either side without increase of pain. He will say that he experiences a feeling of heat, pricking, cutting, or soreness in his inside; involuntarily he relaxes the abdominal muscles, and sometimes fomentations, and even the weight of the bed-clothes, cannot be borne. The breathing becomes quick, shallow, and almost entirely thoracic, and instead of being 18 or 20 it may be 50 or even 60 in the minute. The downward pressure of the diaphragm is instinctively as much as possible avoided, because it moves the abdominal organs, and all movement gives pain. The passage of flatus along the bowels is followed by the same effect. With regard to the pain, which is a cardinal sign, it presents some differences; sometimes it is permanent, in other cases it is paroxysmal, assuming a spasmodic character, and in a few rare examples it is not present in marked degree. As the rule, it is the chief and most reliable symptom.

There is always between this disease and the features great sympathy. The face becomes pale, the cheeks collapse, and the eyes seem set and sunken in their foramina. It assumes the Facies Hippocratica, or what the French term the *Facies Grippée*. Nausea and vomiting often come on with the other symptoms, the ejected matters being a mucoid, biliary fluid; or, in the case of obstructed bowels, the vomited matters may be stercoraceous. Tympanitis is never absent, and often very distressing. The loss of tone in the muscular coat, and the irritation which is conferred on the mucous surface of the alimentary canal, account for such condition. The distension varies in degree. In those whose bodies are flabby and resistless it is often excessive, whilst in the robust and muscular it is in less amount. If the diaphragmatic covering becomes inflamed, singultus often occurs; when the serous coat of the stomach is involved, sickness is urgent; if that of the urinary bladder, there is strangury; and the inflamed tunic of the kidneys will produce ischuria renalis. Percussion elicits the loud tympanitic note, especially in the umbilical and epigastric regions. When there is effusion of serum —which, of course, gravitates to the lower parts—the line of dulness can be most distinctly observed, and it is in some measure altered according to the position of the body. Palpation can only be had recourse to with great care, as the extreme tenderness and muscular resistance prevent much manual examination. When effusion has taken place, and coagulable lymph has matted the intestines together and formed roughened deposits on the liver, spleen, or some tumor, and when albuminous concretions adhere to the parietal peritoneum, the flat hand laid on the abdomen feels a peculiar thrill or vibration, which is most distinct during

inspiration. This sign only obtains when the lymph is thrown out on a resisting basis. Auscultation discovers a creaking friction sound, which is variable in character and intensity, and can only be present for a short time, as of course, on the advent of adhesion, nothing can be heard. The physical signs of pericarditis and pleuritis are far more common. Death is ushered in by quick and thready pulse, cold and clammy surface, loss of heat in the feet and legs, accelerated and labored breathing and general declension of power, the mind being often clear and collected to the last. Pemberton says the patient frequently expires on the sixth, seventh, or eighth day. But it is equally true that the fatal issue often occurs in two or three days. In puerperal Peritonitis the average duration of the disease has been shown to be about thirty hours, and sometimes, as in perforation, it may be even less than ten hours. When the affection assumes a more chronic form, the patient may live so long as thirty or forty days.

The asthenic type of Peritonitis occurs in the cachectic, and those whose vital powers have been undermined by some previous disease. It is that form which is seen as metastatic of erysipelas and rheumatism, and in connection with the exanthems, malignant fevers, puerperal women, and when there is perforation of some part of the digestive tube. It proclaims contamination of the blood and want of vital power. The effusion is sudden, large in quantity, of debased character, and notably deficient in organizable plasma. The pulse is soft and feeble, the surface soon becomes moist, and all the phenomena proclaim declension of vitality.

When the disease terminates by *resolution*, a gradual improvement of all the symptoms becomes observable. The symptomatic fever declines, the pain is less urgent, and pressure can be borne on the abdomen; the skin is moderately moist, but not below the ordinary temperature; the tongue looks cleaner; the pulse is slower, fuller, and softer; the respiration is more normal, being less frequent and not so thoracic; the alvine evacuations are freer and more natural; and there is generally a copious secretion of urine, which contains an abundance of lateritious deposits. Sometimes moderate diarrhœa or diaphoresis are critical discharges. The sickness and vomiting cease, the tympanitis and feeling of distension obtain in less degree, and the patient can extend his legs and lie on either side with more freedom and ease. Lastly, the countenance, which had hitherto been so faithful an index of the complaint, looks calmer and more natural, it having lost much of the sunken, collapsed appearance above described.

One of the most frequent results is *effusion;* indeed, the affection cannot assume a well-marked and typical character without one or other of the inflammatory products being thrown out, and these, as to their proportion and quality, are varied in every individual example. In the earlier stage of the attack the effusion is but small, and not such as in marked manner to increase the size of the abdomen. It gravitates into the pelvis and the iliac fossæ. It can be detected by percussion over the lower parts of the belly, and there are general signs which indicate its presence. When it increases, the pain becomes a less prominent symptom, the pulse is softer, there is a feeling of weight and dragging in the body, chilliness and a diminution of animal heat, the extremities having a tendency to become cool. In such cases as are metastatic of some other complaint, the effusion is much more rapidly generated and the serous proportion is relatively very large. Andral records an illustration which was metastatic of rheumatism, and which ran through its course to a fatal termination in three days, and the autopsy showed an enormous quantity of serum tinted with the coloring matter of the blood, and some floating flocculi and false membranes. When pus is secreted, rigors are a common symptom, with febrile exacerbation in the evening, and the pulse is quicker. It is not, if in any notable quantity, absorbed. It finds an exit either by forming an ulcerated opening into the bowel, which is always fatal, or, which is much more common, it establishes a fistulous passage by way of the psoas muscle, or through some part of the abdominal walls. In this tendency to appear at the surface it seems to obey the law of an ordinary abscess.

Inflammation of the peritoneum rarely ends in *gangrene*, and it is still more rare for any considerable portion of the membrane to become gangrenous. When it has come on, it has generally been at or about the vermiform appendix, or when some part of the bowel has been unduly stretched or strangulated; and, according to Abercrombie, it is invariably accompanied with false membranes. The sudden cessation of pain, singultus, coldness of the surface, thready compressible pulse, general declension of strength, and the Hippocratic countenance, are indicative of this condition.

Sometimes the acute gradually passes into the chronic form, when, as before remarked, the patient does not die until after five or six weeks. He may live even several months. In such cases the effusion may not be absorbed nor yet evacuated, or a fistulous communication may have been produced, and all the conditions of asthenia usher in the mortal event. Again, in other examples, the se-

rous fluid will be absorbed, the adhesions become firm and organized, or the serо-purulent or purulent matter be discharged, and slow recovery result.

The phases which the inflammation of this membrane may assume are very varied; and it is only by the study of a large number of examples that the physician can anticipate and comprehend the modes of its progress. Sometimes that cardinal symptom, pain, upon which such emphasis has been laid, only obtains at the outset; and notwithstanding its subsidence, the malady goes on. Occasionally, as in pleuritis, there may be little or no pain from first to last, whilst rigors and hectic and wasting pronounce still the seriousness of the case at a time long after that period when danger is generally thought to have passed away, and a large collection of pus is contained in the cavity; or the acute symptoms may rapidly subside under a properly directed antiphlogistic treatment, and the condition of simple ascites will only appear to be present; again, disease instituted in some of the abdominal organs will greatly modify the affection after it has become chronic. In this state adhesions alter the configuration of the abdomen by large masses of fibrin being deposited together, by the soldering of the intestinal convolutions, the agglomeration of one organ to another, or by the formation of separate collections of matter in distinct septa resembling independent abscesses. It sometimes happens, too, that the belly becomes soft and flabby, and, instead of improvement succeeding this disappearance of the tension, convalescence is slow and protracted. From what has now been said, it is obvious that the chronic condition is far from being uniform in its phenomena, and that the pathological changes may be diverse and multiform.

VARIETIES.—Broussais and some other authorities speak of the induction of Peritonitis by the exudation of blood into the abdominal cavity without solution of continuity in any of the bloodvessels. I have never seen such an instance, and these examples must be extremely rare. Such sparse exceptions are to be associated with the hemorrhagic diathesis, the predisposing causes being the sanguine temperament and a marked tendency to inflammatory complaints. According to Broussais, the pulse is at first full, but soon becomes soft and compressible, the pain very acute, often intermittent, and coldness of the extremities and convulsions quickly close the scene.[1] Laennec was one of the first to draw attention to hemorrhagic exudations of serous membranes, and Rokitansky attributes such tendency to the tubercular cachexia, the diseased condition of the blood resulting from cirrhosis of the liver, the scorbutic constitution, and the dyscrasia of drunkards. The effect of specific poisons, such as induce the various febrile diseases, and that anomalous condition of the blood now spoken of in which its fibrinous constituent is diminished, and its serous part augmented, are to be enumerated in the causation of this hemorrhagic exudation. When the blood having this origin is discovered in the peritoneal sac, it is in large quantity, very red, and in varying proportions mixed with serum.

There is another description of Peritonitis which systematic writers have recorded, and to which the name of *latency* has been given. It has been said to attack those laboring under some other ailment, the feeble and attenuated, the aged, the insane, and such as exhibit a low degree of vitality. Its symptoms at the outset are masked and difficult of recognition, and, when recognized of the asthenic type, the features present those distinguishing traits before insisted upon as being characteristic of this complaint. It is evident that such examples are nothing more nor less than secondary affections like unto pneumonia in albuminuria, pleuro-pneumonia when intercurrent in phthisis, pericarditis in rheumatism, and arachnitis in continued fever.

Non-plastic or Erysipelatous Peritonitis.—This is seen as the sequel or complication of the exanthems, in adynamic fevers, and in puerperal Peritonitis. Its essential condition is some hæmic change, and it is characterized by asthenia. It is met with in worn-out and undermined constitutions, in the unhealthy, and in those who have had some other malady. Its supervention is sudden, and it runs its course with great celerity. It does not bear an antiphlogistic or lowering treatment, and is only benefited by stimulating and sustaining remedies. According to Abercrombie, "the symptoms are sometimes slight and insidious, but sometimes very severe; and they are chiefly distinguished by the rapidity with which they run their course, and by a remarkable sinking of the vital powers which occurs from an early period, and often prevents the adoption of any active treatment. A remarkable circumstance in the history of this affection is its connection with erysipelas, or with other diseases of an erysipelatous character."[1] Illustrative of this form of the complaint he gives the instance of a woman who had erysipelatous inflammation of the

[1] Broussais Histoire des Phlegmasies ou Inflammation chroniques.

[1] Pathological Researches on the Diseases of the Abdominal Viscera, 3d edit. p. 181

throat, who was very suddenly seized with abdominal pain and vomiting, and who gradually sank in forty-eight hours. The necroscopy discovered a large quantity of pus in the peritoneal sac. And he gives other and similar examples. This physician also refers to an epidemic of erysipelatous character which occurred amongst the children in the Merchants' Hospital, Edinburgh, in 1824. The disease was of mild type. In all the cases there was throat affection, consisting of a raw, red appearance, swelling, and aphthous crusts. Two of the little patients speedily sank, and inspection revealed pus in the abdominal cavity. Abercrombie draws a comparison between this epidemic and one of diphtherite, as it was then named, which appeared two years afterwards, and he believed them to be congeners. The correctness of this opinion later years have confirmed. Between diphtheria and erysipelas there is great resemblance. They are both referable to general blood change, and, as it has been well remarked, are associated with a large group of maladies which stand in close relation with pyæmia.[1] The kind of Peritonitis spoken of occurs with a depressed vitalism, consequent upon toxæmic agents imbibed from without or formed within the organism by its own power of genesis; and the term non-plastic well applies to the ostensible difference which there is between this type, deficient in organizable plasma, and the adhesive form of inflammation.

Perforation of the Peritoneal Membrane.—There is no form of Peritonitis which is so fearful and fatal as that in which there has been positive solution of continuity of the membrane, because this accident generally implies the extrusion of some secretion or fluid or substance into the serous cavity. Several of the older authors mention this occurrence, and some vaguely attribute such openings to worms—a *possibility*, as we know from Andral's case, in which lumbrici passed into the cavity; but this event is exceedingly rare. There is no doubt that in nearly all these recorded instances the real cause of such perforations was ulcerative destruction, or cadaveric change, which former writers had not recognized with that facility and certitude which distinguish the acquisition of modern pathologists. Perforation may be produced in a great variety of ways, by penetrating wounds made by sharp or blunt instruments, the crushing effect of accidents, lacerating the solid or hollow viscera, or the parietal peritoneum; corrosive poisons, the giving way of the uterine walls during parturition, the softening of a fibrous tumor attached to the uterus and the contents being extravasated; the bursting of a Graafian vesicle, of a mesenteric gland, of a tubercular deposit, of the urinary or gall-bladder; from calculi, from the evacuation of some collection of purulent matter, as in empyema; burrowing through the diaphragm, in abscess, as before remarked, of the liver, spleen, or kidney, in pelvic abscess, and from other causes. Mr. Hulke lately recorded an instance of renal abscess bursting into the peritoneal sac, which occurred in an unhealthy-looking maid-servant who was admitted into the Middlesex Hospital for hip disease, and which ended fatally. The inspection discovered puriform serum in the peritoneal cavity, and the peritoneal surfaces were coated with a soft yellow lymph. The right kidney was a mere sacculated pouch, and it was ruptured at its upper end.[1] The more common cause of perforation is ulceration, commencing in the mucous membrane, of some portion of the digestive tube, and penetrating through the muscular and serous coats. It may be referable to softening of the intestinal wall (*ramollissement gélatiniforme*), or to cancerous disease, especially when the cancerous deposit encroaches upon, or absolutely blocks up, the passage. When the accident is from this cause, it is mostly observed in the stomach, colon, or cæcum.

The symptoms are sudden, often violent. Frequently the patient at once falls into collapse. Andral says, that sudden increase of prostration and rapid change of the features are sometimes the only symptoms denoting the accident of perforation. Sometimes there is febrile excitement, as evinced by increased heat of surface, hard pulse, and urgent thirst. In the great majority of cases remedies seem inoperative; the disease rapidly becomes diffused over the surface of the sac; whilst vomiting, dorsal decubitus, quick and feeble pulse, loss of animal heat, and sunken and collapsed features, too truly indicate the powerful impress which has been made upon the circulatory and nervous systems, the mental faculties, generally, remaining unaffected to the last. In those very exceptional cases in which recovery does take place the vomiting begins to subside, the distension to decline; the pulse becomes softer, fuller, and slower; the face is less haggard, the patient sleeps more tranquilly, and the temperature of the body is more natural.

When the stomach is the seat of perforation, as it sometimes is, by simple or specific ulcer, the phenomena are precisely those which obtain when any other part of the sub-diaphragmatic tube gives way. Ulceration of this organ is most frequent

[1] Dr. Russell Reynolds, art. Erysipelas, vol. i.

[1] Lancet, Jan. 23, 1866.

in females. Dr. Brinton found that in 654 cases 440 were in females, and 214 in males. He also says that in the former sex one-half occurred between the ages of 14 and 20.[1] It happens to children. Dr. Lee knew perforation of the stomach of a girl of eight, and in that of a boy of nine years of age. The opening is most frequent at the splenic end, and that part is also most prone to gelatiniform softening. It may give rise to hemorrhage. Habershon gives an example in which the splenic and pancreatic arteries were opened. It does not absolutely follow that death shall always eventuate, because adhesion may take place between the point of ulceration and the abdominal walls, or one of the solid viscera, or a communication may be established between the stomach and the colon, or the duodenum, or a gastric fistula may be formed externally, or through the diaphragm into the thorax. The last two named are very uncommon, but possible contingencies. Abercrombie gives an example of the kind of Peritonitis now considered. A young woman had been affected with dyspeptic symptoms and epigastric pain for some months. On Nov. 26th, 1824, she was heard to scream violently, and when approached was unable to express her feelings except by violently pressing her hand against the pit of the stomach. The abdomen became tender and distended, and she continued in extreme suffering till the 27th, when she died twenty-nine hours after the attack. On the inspection of the body the cavity of the peritoneum was distended with air, and likewise contained upwards of eight pounds of fluid of whitish color and fetid smell. There was slight but extensive inflammatory deposition on the surface of the intestines, producing adhesion to each other, and to the parietes of the abdomen. In the small curvature of the stomach was a perforation which admitted the point of the little finger.[2] This author gives another case in the person of an elderly gentleman, who was suddenly seized with excruciating pain at the stomach, accompanied by vomiting, coldness, and quick pulse. The abdomen became tense and tender, and he sank in thirty hours. Necropsy exhibited near to the pyloric opening an ulcerated hole larger than a shilling, to which the liver formed a base, and a little below the perforation of the calibre of a quill through which the contents of the stomach had escaped and caused fatal Peritonitis.

The duodenum is less liable to this accident than the stomach; but its serious tunic does sometimes give way under the ulcerative process. Mr. Curling was the first to observe that the glands of Brunner are apt to pass into ulceration during the progress of severe burns, and from this cause Peritonitis may in a secondary manner result. In twenty-two autopsies made by Louis in enteric fever, in only two cases was the villous surface of the duodenum found ulcerated. In fifteen examples of that disease examined by Jenner, and in twenty by Murchison, no morbid condition was detected in this organ. Its ulceration in all its characteristics and consequences very nearly resembled that described of the stomach. Habershon says several cases have come under his observation, the early symptoms of the ulceration being slight until fatal Peritonitis had been set up by perforation. In other instances violent vomiting produced the accident. Hodgkin relates the instance of a young woman, aged twenty-four, who was admitted into Guy's with urgent vomiting, small and feeble pulse, and who shortly after died of fatal Peritonitis caused by a small ulcer in the duodenum. Habershon gives an interesting example in a young woman, aged eighteen, admitted into Guy's, February 19th, and who died October 4th, 1860. At first the prominent symptom was vomiting; after a time diarrhœa came on, and the emaciation increased. Examination of the body showed behind the first portion of the duodenum and close to the pancreas a collection of offensive pus, and a perforation a quarter of an inch in diameter was discovered. From the histories of six cases recorded by Dr. Andrew Clark,[1] he concludes that the event is sudden, after food, and that the pain never leaves its place of origin. In the examples given by this physician there was no sensatien of something having given way, nor of heat diffusing itself over the belly. This organ is more frequently perforated by secondary than primary disease. The malignancy of neighboring viscera is sometimes extended to its parietes, as in cancer of the stomach, liver, spleen, pancreas, and lymphatic glands, and its consequent rupture is followed by Peritonitis, which ends fatally.

With regard to the jejunum it is rarely found morbid, and assuredly no part of the digestive tube possesses such an immunity from disease. I have known no instance of its perforation. Neumann and

[1] Dr. Brinton gives the following relative proportions per cent. of the locality of perforations which ended fatally by Peritonitis:—

Posterior Surface	2
Pyloric Sac	10
Middle	13
Lesser Curvature	18
Anterior and Posterior Surface at once	28
Cardiac Extremity	40
Anterior Surface	85

[2] Abercrombie's Diseases of Stomach, 3d edit. p. 34.

[1] British Medical Journal, June 22, 1867.

Hufeland, however, have recorded an example of this event.

Perforation more frequently occurs in the lower third of the ileum, and near to the ileo-cæcal valve, than in any other part of the intestines. Of ten cases by Louis, it was within a foot of the valve. Of ten cases given by Stokes, in nine it was within twelve inches of the valve, and one was in the cæcum. Of eleven by Murchison, nine were within twelve, and two within eighteen inches of the same place. Bartlett saw it forty-four, and Bristowe seventy-two inches from the same place. The parts next in order of prevalence are the cæcum and vermiform appendix. Louis was one of the earliest observers of the facts now noticed. It has long been broadly and familiarly known that the agminate glands which are proper to the ileum, and the solitary glands which are scattered throughout the villous coat of the digestive tube, are in enteric fever very prone to take on the ulcerative condition, more especially the patches of Peyer, and occasionally it happens that after the mucous and muscular coats have been destroyed, the peritoneum gives way. These glands are not in like manner predisposed to disease in the course of any other acute affection. The vermiform appendix has in repetition been found the seat of fatal Peritonitis, not only in enteric fever, when sometimes only a very minute orifice can be discovered, but from the impaction of some foreign body, as the seed of fruit, a kernel, a piece of bone, a piece of indurated fecal matter, or even the single bristle of a tooth-brush. Of eight cases of perforation given by Louis, seven were in the young and vigorous, and it may here be observed that more recent writers, as Jenner, Murchison, and Bristowe, have shown that it chiefly occurs between the ages of fifteen and twenty. Of the eight cases by Louis, with a single exception, the disease commenced with continued fever, nor did the febrile phenomena assume any severity of character until the advent of the perforation. In four there had been diarrhœa, but only in one were the bowels much harassed. Tweedie says the state of the bowels, either as to the presence or absence of diarrhœa, is not to be depended upon, as it sometimes happens that the evacuations are healthy when the bowel gives way. Three were quite convalescent when the opening occurred, and a fourth appeared to have fully recovered from an attack of enteritis.

Since Louis wrote his account, much information has been accumulated on this particular subject. It is now well known to all who have made the various forms of fever a special study, that there is no precise correlation between the gravity of febrile symptoms and the occurrence of perforation. The diarrhœa may have been a distressing and persistent symptom, and yet the points of ulceration may not have been either numerous or deep; on the other hand, in cases regarded as mild forms of fever the bowel may very unexpectedly burst, and this event is generally at a later date of the attack, or during convalescence. Tweedie has known it take place when the patient has so far recovered as to leave the house. Dr. Murchison lately published an apt illustration.[1] Some time ago I had under my care a girl in enteric fever who became quite convalescent, and at the end of six weeks, after eating a hearty meal of solid food, Peritonitis supervened, and she died in twenty-two hours. Peacock saw it come on so soon as the eighth, and Murchison on the ninth day of fever. Louis noticed it so late as the forty-second, and Jenner on the forty-sixth day. Of thirty-two cases given by Murchison, perforation occurred during the second week in eight cases; during the third week in six, during the fourth week in nine, and after the fourth week in nine.[2] Louis says, if in acute disease, and in an unexpected manner, a violent pain in the abdomen supervenes; if this pain is exasperated by pressure accompanied by rapid alteration of the features, and more or less promptly followed by nausea and vomiting, we may believe and announce that there is perforation of the intestine.[3] Pain is not a symptom in all cases continuous up to death. It sometimes notably abates, and in exceptional examples ceases entirely for several hours before dissolution. Jenner saw a patient in whom there was no pain at all, vomiting and cold extremities being the only symptoms. Tweedie asserts that the symptoms of this event are not uniformly well pronounced. The accident may be masked by delirium so considerably that the time of perforation and its absolute occurrence may be uncertain.

Dr. Stokes gives particulars relative to nine cases which occurred under his own observation.[4] These happened during fever; one in catarrhal fever, two after acute enteritis, and in one case hypercatharsis produced by an overdose of salts was the cause. In several of these nine instances there had been diarrhœa. He also comments upon a fact worthy of notice, that in three were produced irritation of the bladder and inability to pass urine. In all, inspection revealed ulceration of the muciparous glands; and respecting the time which the patient lived after the initiatory symptoms of perfora-

[1] British Med. Journal, Dec. 2, 1865.
[2] On Fever, p. 508.
[3] Recherches Anatomico-Pathologiques.
[4] Cyclop. Pract. Med.

tion, it varied from twelve to one hundred and twenty hours. Stokes also says that the average duration, deduced from nineteen cases which he had collected from various sources, was twenty-nine hours. Louis's patients lived from twenty to twenty-four hours. Murchison has known death follow in four hours, and not until one hundred and five hours. I have known it from seven to twenty-three hours. The period subsequent to the accident must needs be influenced by a variety of circumstances, such as the character of the antecedent or coetaneous disease, the vital powers of the patient, the extent of the orifice, and the kind and quantity of lymph thrown out, the part of the bowel, and the conditions favoring or opposing adhesion. If in a fever of the adynamic type, when the powers of the system are much reduced, the shock may be such as at once to usher in a fatal collapse. If the opening be in immediate apposition with another coil of the bowel, a solid organ, or the walls of the abdomen, the extrusion of the contents of the canal may for a time be arrested. Bristowe relates a case in which the patient lived fourteen days after perforation. I remember an instance in enteric fever in which there was a hole that would have admitted a swan-shot on the lower part of the ileum, but depositions of pearly lymph had so effectually sealed up the opening that none of the intestinal contents had escaped. When, however, they do escape, the inflammation becomes so intense that remedies are generally powerless. Chomel, Louis, Rokitansky, and Jenner say it is *always* fatal. Tweedie, Todd, Ballard, Fox, Bell, and Murchison aver that they have known recovery. The last-named relates the instance of a girl of sixteen, who, on the thirty-first day of fever, was suddenly seized with severe pain and tension of the abdomen, urgent vomiting, and all the symptoms of collapse. A grain of opium was given every second hour, and during the first thirty-six hours ten grains were taken. The patient made a tedious recovery, and was discharged from the hospital fifty-five days after the commencement of Peritonitis.

In some exceptional examples, the more formidable symptoms will apparently subside, and life be preserved for even several days. This deceptive kind of amendment should not, however, throw the physician off his guard; he should not forget those grave and alarming indications which pronounced the existence of the accident, as it almost invariably proves that the mortal end has only been deferred, not averted. In the case observed by myself, if there was no absolute escape of the intestinal contents, the soft lymphic plug could not for any great length of time have sufficed to act as a barrier to extravasation. Some slight strain, as in the evacuation of the bowels, coughing, sneezing, or the mere motion of the body, might doubtless have been sufficient to remove the non-organized albuminous deposit, and render the opening free. Notwithstanding the well-nigh hopelessness of all cases in which there is positive solution of continuity, it is from pathological reasoning a possibility that recovery may succeed. Nature attempts to repair the lesion by throwing out plastic materials, and if these,—by utter rest, and by opiates subduing the peristaltic action of the bowels,—be allowed to lie in contact with the breach sufficiently long to become permeated with new vessels—to be organized—the orifice may be repaired: such reparation, however, can only be effected when the hole is small, and then it is but a mere possibility.

Though the first symptoms of perforation are nearly always distinct and terrible, in exceptional cases they may be ill-defined and obscure; or they may gradually assume increased severity. They will be influenced by the size of the aperture; for instance, the solution of continuity, when it takes place in the appendix, is sometimes very minute, and the escape of irritant matters inconsiderable. The orifice may at first be small and by degrees enlarge, and relatively with the enlargement (and consequent greater extravasation of liquid and fecal contents) will increase the irritation conferred to the sac and the more manifest phenomena of inflammation. Confirmative of these assertions, Dr. John Harley may be cited. "In some cases," says this physician, "the perforation has taken place so gradually, the aperture formed is so small, and the extravasation so inconsiderable, that the symptoms of Peritonitis come on and attain their maximum very gradually, and without any sudden increase in the severity of the symptoms."[1]

The colon is occasionally perforated in fever, but it is much less prone to this result than the parts last named. Chomel, Brinton, Forget, and Murchison mention five instances. In two out of three cases the opening was at the junction of the transverse and descending colon; and in the three others at the junction of the sigmoid flexure with the rectum.[2] The last-named authority lately gave a good example of the giving way of the large intestine. "A young man of eighteen was admitted into the Fever Hospital, Aug. 23, 1865; he had been ill fourteen days, and on admission was very ill of typhoid fever with Peritonitis. The pulse was quick and feeble, the body enormously distended and tender, the motions fre-

[1] System of Medicine, vol. i.
[2] Murchison on Fever, p. 551.

quent and watery, and the breathing thoracic. He died Sept. 7. Inspection discovered the entire surface of the peritoneum to be coated with a thin layer of lymph which could be stripped off with a knife. There were three perforations in the large intestine, one about three and a half inches below the valve, and two in the sigmoid flexure. There were no contents of the bowel in the serous sac."[1]

With respect to the average of perforation in fever, Murchison states that out of 435 autopsies recorded by Bretonneau, Chomel, Montault, Forget, Waters, Jenner, Bristowe, and those made at the London Fever Hospital, it occurred in 60 cases, or in 13·8 per cent.[2] It probably happens in about three per cent. of those who have enteric fever, and more frequently amongst males than females.

In chronic dysentery, sometimes, after ulceration has destroyed the mucous and muscular coats, the peritoneum is penetrated. In such instances the special and general symptoms, which characterize the primary disease, point to a correct diagnosis. In cancer of the bowels perforation may occur: it is more frequent in the large than small intestines, and Rokitansky says the colon is almost exclusively the seat of cancerous degeneration. I saw in consultation some time ago a gentleman laboring under diffuse Peritonitis, which had evidently been caused by a large hard tumor, the size of a cricket-ball, in the left hypogastric region. The stools were flattened, but the passage was evidently quite patulous. I gave it as my opinion that it was a case of cancer of the large bowel. A surgeon was at this juncture called in, and he strangely enough proposed Amussat's operation merely to give exit to the flatus, when large pieces of fecal matter were voided, but fortunately that suggestion was overruled by two of the most eminent members of the profession. In the course of a few days the patient died. Perforation was announced by a sudden and terrible increase of pain, small pulse, sunken features, and cold extremities. The autopsy revealed abundant proofs of foregoing and present Peritonitis. There were several pints of serum in the abdomen, which contained loose flocculi; the descending colon was adherent to the abdominal walls, and a little above the sigmoid flexure was a cleanly cut, punched hole, the size of a small pea, through which a large quantity of thin feculent matter had passed into the peritoneal sac. The upper third of the rectum, and the opening into the sigmoid flexure, were the seats of cancerous deposit, and the canal was patulous.

[1] British Medical Journal, Dec. 2, 1865.
[2] On Fever, p. 511.

Habershon divides perforations into two great classes, those which arise from disease commencing in the intestine itself, as by the ulceration of fever, dysentery, cancer, and the various forms of insuperable constipation; and those in which perforation is from without, as in strumous Peritonitis, ulceration of the stomach extending to the transverse colon, hydatids, and abscess of the liver, calculi, abscess in the other solid viscera or abdominal walls, cancer, extra-uterine fœtation, and external injuries.[1] It may be caused by laceration of the gall-bladder. Barthez and Rilliet mention a case in a girl of twelve whilst in fever, and Murchison gives another instance in a young man of nineteen, who was suddenly seized with Peritonitis on the fifteenth day of the fever, and who died in twenty-six hours. It is rarely observed as the result of tubercle. Sir Thomas Watson, in his large experience, only remembers a single instance. Of fifty-six cases collected by Habershon, four only were from strumous disease. Jenner once knew a softened mesenteric gland give way during fever, and Buchanan saw a fatal case of Peritonitis from the bursting of a softened embolic deposit in the spleen of a typhous patient.

Puerperal Peritonitis.— In the discussion of this part of the subject I may here observe that it is not my purpose to enter upon the consideration of puerperal Peritonitis as it occurs epidemically; but as I believe with many other writers that puerperal women are liable to a simple form of Peritonitis, its description necessarily comes within the limit of this article. Sporadic cases from time to time occur without the diffusion of the disease, but even then it is right to observe the utmost caution, as so much doubt is always involved with regard to its contagious nature. Inflammation of the serous covering of the uterus and its appendages may, I believe, supervene as an incidental circumstance, without the superaddition of a specific poison. The great effort of the organism, the irritable condition of the body, after the exhaustion of expulsive endeavors, the long distension of the uterus and the abdominal walls, and their sudden contraction; the friction of opposed surfaces in the abdomen during labor, and the great excitation given to the circulatory and nervous systems, may produce Peritonitis. Other causes operate in the production of this result, as injuries inflicted during instrumental delivery, in turning, adhesion of the placenta, the use of cold affusions in flooding, and the improper administration of stimulants. Contamination of the blood, originating in

[1] Diseases of the Abdomen, 2d edition, p. 530.

the body itself, without reference to external agencies, as when absorption takes place from putrid coagula or a piece of retained placenta, is another mode by which the malady is originated. In uræmic poisoning, as before remarked, the serous membranes are predisposed to inflammation, and the blood vitiation during parturition resembles this cause.

There is, I need scarcely say, still much conflict of opinion relative to the real nature of abdominal inflammation after child-birth. By some it is yet maintained that Peritonitis and puerperal fever are identical—that these terms express but one affection. It is true that in a large proportion of those who die of puerperal fever the peritoneum is inflamed, but this membrane is not *always* involved; and although this form of inflammation accompanies this disease far more frequently than any other form, yet puerperal fever is something still more. Of 222 autopsies of puerperal fever, given by Tonnelli, in 193 were traces of Peritonitis; in 29, or one-eighth, there were no traces whatever. Of 44 cases examined by Lee, the peritoneum and uterine appendages were inflamed in 32, or in the relative proportion of 8 cases out of every 11. Dr. Bartsch, in a report of the Midwifery Institution at Vienna, records the morbid appearances of 109 cases of those who died of puerperal fever, and in this report puerperal fever is distinguished from Peritonitis and metritis. "The cases of puerperal fever," he says, "occurred *seldom under the form of puerperal Peritonitis*, but generally as inflammation of the uterine veins, giving rise to the production of pus in these vessels, and the general symptoms accompanying its absorption."[1] Let any one, says Fleetwood Churchill, compare a case of simple inflammation of the womb or peritoneum in child-bed, with a case of epidemic puerperal fever, their symptoms, course, and the effect of remedies, and I do not think a doubt will remain upon his mind, that although the latter is a local disease, it is not exclusively so.[2]

The symptoms common to this form of Peritonitis may come on in a few hours, a few days, or even so long as two or three weeks after delivery. Pains and rigors are generally the first indications, and pain on pressure is more distinctly felt at the hypogastrium than at any other part. The skin is hot, the cheeks are flushed, the pulse is quick, and the respiration hurried. The pain soon radiates from the hypogastrium into the iliac fossæ, and then to the other parts of the abdomen. It is not always severe, and is sometimes characterized by paroxysmal attacks, the patient being free from suffering during the intervals; nor can it be said that this symptom pain is pathognomonic of puerperal Peritonitis, because post partum uterine pain may be urgent when there is no coexistent inflammation, and there may be inflammation with little or no abdominal pain. Churchill asserts that he has seen five or six cases of intense Peritonitis as proved by dissection, in which there was neither pain nor tenderness;[1] and Ferguson records that he has known nineteen cases in which there was no pain.

The abdomen suddenly becomes large, more quickly and to a greater extent than in any other kind of Peritonitis, which may be accounted for by the often relaxed and resistless condition of the muscular system of parturient women, and because the abdominal walls have been so recently distended. At the onset of the attack the uterus can be felt above the pelvic brim, soft, flabby, and uncontracted, but as the distension obtains in greater degree it cannot be distinguished. The lochia are at once diminished or suspended, or their absolute suppression may precede the inflammatory phenomena. If the milk has begun to flow, its secretion is arrested; if it has not begun, it is prevented. If the mammæ have been full and rounded, they fall in and are flaccid and smaller. The pulse varies, but it is always above, in the great majority of cases greatly above, the normal standard. In non-inflammatory, uncomplicated cases, the circulation may be accelerated, for a day or two, or two or three days, but there is a gradual declension of its frequency from the time of delivery. If, however, after delivery the pulse shall have fallen to, or near, its natural number, and it then suddenly begins to rise, accompanied by local pain, higher temperature, thirst and diminished secretions, the cause is often obvious.

After-pains may be confounded with those of inflammation. They come on soon after delivery, but decrease in force and frequency as time wears away. Peritonitis does not come on so soon, and its symptoms become more and more proclaimed, instead of diminishing. After-pains are associated with a firmly contracted uterus; Peritonitis with a relaxed uterus. Remedies which relieve the former are useless or harmful to the latter. In the one affection the circulation may be natural; in the other it is never so. At the first the diagnosis is very difficult, because after-pains may be followed by inflammation, and for a time the symptoms be mixed up; but the progress of the case leads to a correct conclusion. When puerperal Peritonitis is accompanied with intestinal irritation and the inflammation has extended to the mucous membrane.

[1] Lancet, April 16, 1836.

[2] Diseases of Women, Syd. Soc. p. 35.

[1] Diseases of Women, 5th edit. p. 783

sickness and diarrhœa may be urgent. When the malady terminates by resolution, the pain abates, the tympanitis declines, the pulse becomes fuller and slower and softer, the skin cooler and moist, the tongue cleaner, the lochia are re-established, the breasts become rounded and milk begins to flow, the legs can with more comfort be extended, and the patient can lie on her side. The conditions of approaching dissolution are—weak and thready pulse, varying from 120 to 160; the abdomen keeps distended and tender, cold clammy sweats come on, the extremities become cold, the breathing is quick, shallow, and thoracic, she lies on her back with legs drawn up, the features are sunken, and the mind often remains calm and clear to the close.

Perityphlitis.—This particular form of disease has been more fully described by French than British pathologists. MM. Husson and Dance[1] give an excellent account of the affection; and it is also well described by Dupuytren, Menière, and Duplay. Amongst the English authors may be named Copland,[2] Syme,[3] Craigie,[4] Farrall,[5] Burne,[6] Sellar,[7] and West.[8] The disease originates in the tunics of the cæcum, and by some it has been named pericæcal abscess; the glands or follicles of this organ at the first become inflamed and then pass into the ulcerative condition. The ulceration of this part of the large bowel may insidiously destroy the mucous membrane, implicate the submucous cellular tissue and peritoneal coat, and either cause inflammation and lymphic adhesion of the latter, or its fatal perforation. When agglutination occurs the lesion may be arrested. Craigie defines the malady to consist in inflammation and suppuration of the cellular tissue connecting the cæcum to the quadratus lumborum muscle and other parts, or in inflammation and ulceration of the mucous membrane of the cæcum; and Sellar says its pathological seat is in the cellular tissue between the fascia of the iliacus internus and the coats of the cæcum.

The causes of perityphlitis may be referred to the peculiar position of the cæcum, as well as to other circumstances. It is attached to the muscles of the right lumbar region, and its sacculated pouch depends below the ileo-cæcal outlet, and, as all physiological anatomists observe, its contents have to be propelled against gravity; and it thus may become distended with fecal matters, and such irritation be instituted by its distension and pressure as to set up inflammation of the lining membrane. Again, hard and indigestible articles of food, the stones of drupaceous fruits, seeds, pieces of bone, and metallic, porcellanous, and vitreous fragments have been known to give rise to it. The complaint has in several recorded cases been present long before its nature has been discovered. Its earliest conditions are rendered manifest by tumescence and dulness on percussion at the right iliac fossa. The circumscribed swelling may extend across to the umbilicus, and when such is the case Peritonitis is generally the accompaniment of other pathologic changes. The patient will complain of pain at the upper part of the thigh, and this has not the same freedom of motion as the other limb. It has repeatedly been found that there has been irregular action of the bowels, associated with colicky pains, which radiate from the iliac region. Dr. West says, that in children the bowels are mostly relaxed, and that pain in the stomach is an initiatory symptom; and he also remarks that the prominence in the right flank sometimes assumes that of an elongated tumor, which reaches from the ramus of the pubis nearly to the hypochondrium, and has a brawny hardness.[1]

When the ailment has for some time subsisted, lymph and purulent matter are deposited in the cellular tissues behind the cæcum, and so long as the strong iliac fascia prevents the escape of pus, a deep and irregular abscess is formed. The secretion at length most frequently passes through the cæcal parietes at the part uncovered by the peritoneum, as recorded by Copland, Duplay, and others. In some instances it is infiltrated into the cellular tissue in front of the iliacus internus, and effects an exit near the anus; or it may pass into the folds of the mesocolon, or make a sinus and be evacuated externally, as in examples related by MM. Husson, Dance, and Menière. Dupuytren knew it extend so high as the right kidney, and so low in the pelvis as to collect between the rectum and bladder. The perityphlic inflammation may be circumscribed and rather of the subacute than the acute type, with adhesion of adjacent surfaces. When the matter perforates the serous sac, diffuse and fatal Peritonitis ensues. [Allusion has been made on a previous page (under

[1] Mémoire sur quelques Engorgements inflammatoires qui se développent dans la Fosse iliaque droite; Répertoire d'Anatomie, &c., t. iv. p. 74. Paris, 1827.

[2] Med. Dict. art. Cæcum.

[3] Principles of Surgery.

[4] Pathological Anatomy, 2d edit. p. 632.

[5] Edinburgh Medical and Surgical Journal, vol. xxxi. p. 1 1831.

[6] Medico-Chir. Transact. xx. p. 200, and xxii.

[7] Northern Journal of Medicine, July, 1844.

[8] Diseases of Infancy and Childhood, 5th edit. p. 656. 1865.

[1] Diseases of Infancy and Childhood, 5th edit. p. 657.

Enteritis) to the occurrence of not a few cases of mild perityphlitis, from which recovery may take place under judicious treatment.—H.]

Peritonitis of Children.—Acute Peritonitis seldom occurs in infancy and childhood. It has been more frequently observed in young infants than in children several years older. Some have declared it may affect the fœtus; in all such instances syphilis in the mother has been regarded as the cause, nor is it improbable that a general taint in the mother should impart disease to the child. Irritation of the digestive surface is more common in children than inflammation of the serous tunic. When Peritonitis does occur, it is generally as a complication or sequel. It may, however, be primary as well as secondary; it may be partial or general; acute or subacute, and then pass into the chronic condition. When it appears it is mostly after one of the exanthematous fevers; more especially after scarlatina or measles. Dr. West has not known more than half-a-dozen instances of acute general Peritonitis in childhood.[1] It has prevailed among young infants when exposed to deleterious external agencies. According to M. Thore,[2] at the Hospice des Enfants Trouvés, at Paris, six per cent. of the infant mortality was from acute Peritonitis. It usually came as the complication or sequel of some other ailment, and no child above ten weeks was attacked by it. The fatal end was generally before twenty-four hours. Of sixty-three inspections in no case was there pus, but in all a greater or less amount of serum on which flocculi floated, and the intestinal coils and solid viscera were adherent. In seventeen out of the sixty-three, erysipelas had preceded the Peritonitis. Pleuritic effusion was discovered in a third of the examples.

The usual symptoms are pain in the bowels, which at first resembles common stomachache. It alternately subsides and returns, and there is mostly diarrhœa. In the course of a few days the pain becomes more fixed, and the child frequently complains of pain in the right side, and if old enough he indicates the locality by putting his hand on the cæcal or umbilical region. The pyrexial phenomena are proclaimed, the little patient looks haggard, he is restless and continually alters his position; pressure over the part makes him cry, and the abdominal muscles are tense. He lies on his back, often with legs extended, and the sickness is not so urgent as in the adult. According to Dr. West, when the affection is of cæcal origin, the right leg is often drawn up and the left extended.

Dr. George Gregory a long time ago described a form of marasmus, which he believed to be primarily disease of the peritoneum, and which he conceived to differ from what Pemberton terms "irritation of the intestines," and the kind of marasmus originating in the mucous membrane.[1] From being met with in scrofulous children, and an "imperfect kind of pus" being produced, he named it scrofulous inflammation of the peritoneum. He regarded it to be distinguished by abdominal tenderness, shooting pains which at first come on in paroxysms, but at length increase in frequency and violence. The pain on touch is first localized, and then becomes diffused. Inspection revealed pus and agglutination of the viscera. But the account of this author applies more to chronic than acute Peritonitis. In acute Peritonitis of children pus is a rare consequence; when it is formed it gravitates into the lower parts of the abdomen, and is deposited in one or more collections or septa. It may be evacuated by pointing externally, as in empyema, or effect an exit by the bowels, and it is possible recovery may follow, but such is a possibility rather than a probability. When it occurs consecutively, as after some fever, and when the powers of vitality are lowered, turbid serum with a few floating flocculi is the common product, as I have already observed when speaking of the non-plastic type of the disease.

Complications.—This affection is often complicated with some other disease. It may be complicated with *gastritis*, a disease which rarely or never occurs in this country as an idiopathic affection, although it is said to do so in warm climates. The physician will, in nearly all cases, discover from the history of the case, or collateral circumstances, the cause of the inflammation. Gastric Peritonitis may be fatal without the contents of the stomach being poured into the serous sac, and without solution of continuity, especially when it occurs in a secondary form. But in such examples the inflammation is only limited. Sometimes tumors press upon the organ and inflame its serous covering, or the inflammatory condition may be there instituted by contiguity, as when neighboring viscera, such as the liver, spleen, and intestines, are thus primarily diseased. Carcinoma, especially of the pyloric end, will sometimes, by the mechanical pressure, give rise to the result in question; when this happens the Peritonitis is generally of the more chronic description. In that

[1] Diseases of Infancy and Childhood, 5th edit. p. 654.

[2] De la Péritonite chez les Nouveaux-nées, in the Archives Gén. de Med. August and September, 1846.

[1] Medico-Chirurg. Trans. vol. xi. p. 263.

form of ulceration of the stomach, which occurs mostly in young women, the general health is often not much affected. It is often much in association with chlorosis, amenorrhœa, leucorrhœa, or submammary pain, and the patient is apt to complain of a gnawing sensation at the epigastrium, accompanied with more or less of anorexia and vomiting. When the gastric peritoneum is rent or perforated by ulceration of the inner tunics, the pain is excessive, the powers of life are rapidly subdued, and death is inevitable.

When the peritoneum is inflamed in *hepatitis* it is generally in a partial manner, and it continues to be circumscribed unless extravasation of some description result, which is occasionally the case, and then the entire sac at once assumes the same morbid condition. Inflammation may begin in the parenchymatous structure and extend to the serous coat, and when such is the fact, the pain becomes more acute and defined, and the pyrexial symptoms are more pronounced. The right hypochondriac region is often full and tense, the normal lines of dulness are extended, there is pain on pressure and deep inspiration, and dyspnœa, coughing, and vomiting are frequent accompaniments. The patient cannot lie on his left side, and the recti muscles are rigid. When the convex surface is affected, the diaphragmatic investment assumes the same disease, and cough is a prominent symptom. The convexity may be inflamed without the appearance of jaundice. When the concavity is inflamed the stomach mostly becomes implicated, sickness is urgent, the gall-ducts are more or less obstructed, and jaundice, in greater or less degree, is a common result. When the parenchyma is alone inflamed, the pain is of a dull aching character. When the serous tunic is involved, the pain is sharp and acute. When lymph in considerable quantity is effused, the organ becomes adherent to adjacent surfaces, and if the albuminous exudation gravitate to the lower part of the abdomen, agglutination of the intestinal folds occurs. When hepatic abscess points to the surface, partial Peritonitis, by pressure, is induced. The effused lymph is protective from the worse consequence of extravasation. Hydatid tumors may, like abscess, excite adhesive inflammation. Cancerous growths occasionally produce subacute hepatic Peritonitis, but the symptoms are ill-defined and obscure. And the same remarks apply to tubercular masses in the capsule of the liver.

Sometimes we observe *acute splenitis* as an intercurrent complaint during the progress of intermittent fever. But, as I have more fully insisted in the article on Diseases of the Spleen, this organ is infinitely more prone to a chronic form of congestion. Sometimes, when during the cold stages the capsule becomes suddenly distended, such tenseness so stretches the fibrous and serous tunics as to usher in the inflammatory process; then pain of sharp and stabbing character, increased by pressure, is felt beneath the left costal cartilages radiating through to the back; the skin is hot, the pulse quick and hard, the urine highly colored and scanty, the tongue furred, the bowels are confined, and if the under surface of the diaphragm has become affected, cough and dyspnœa are associated symptoms. The patient lies partly on his back with trunk curved to relax the abdominal muscles. Towards evening there is exacerbation of the symptoms. Post-mortem examination reveals the serous investment thick and reddened, and the organ united to neighboring parts by albuminous exudation; and it is here not unworthy of remark, that in the peritoneal inflammation of this viscus, cartilaginous and ossific conversions are more frequent than in the peritoneal inflammation of the other solid abdominal organs.

In *enteritis*, when all the coats of the bowel are inflamed, the disease may commence in the mucous membrane, at first sickness and purging being urgent. In such cases colicky pains come on at intervals, and moderate pressure produces little or no uneasiness, and at this stage of the malady it is often difficult to form a correct diagnosis. If the complaint make progress, if the skin become hot and dry, the pulse quick, the face flushed, and pain be felt on pressure, it is of great practical importance to distinguish the kind of lesion to which the disease has advanced, because remedies which would relieve the colic would be absolutely injurious in inflammation. Instead of diarrhœa there is often constipation; thus it is when mechanical obstruction of the gut is the cause of its being inflamed, as in intussusception, and when tumors block up the passage, and vomiting of stercoraceous matters proclaims the inverted action of the bowel. The general and special signs of the peritoneum being inflamed are the same as those above described. In *children* the complaint is frequent during dentition, and it sometimes comes on as the sequel in eruptive fevers. Crude and indigestible articles of food in these little patients are often the cause. Its advent is marked by languor and peevishness, the child is restless and complaining, green mucoid stools emitting an offensive odor are voided, the cheeks become flushed, the belly tender, and all the conditions of peritoneal inflammation are superadded to a fever of the remittent type. And dissection sometimes exhibits the entire substance of a portion of the

ileum presenting a gangrenous appearance in addition to the ordinary products of serous inflammation.

In *nephritis*—which is in the great majority of instances brought on by calculus in the pelvis of the kidney, blocking up of the ureter, some irritant drug, or some blow or external injury—severe pain over the loins following the course of the ureter on the same side, and, in the male, retraction of the testicle, high-colored urine, and nausea and vomiting are common symptoms; and, as is occasionally the case when ischuria renalis supervenes, uræmic symptoms are apt to mask and obscure the otherwise more apparent features of peritoneal complication (*perinephritis*). The urinary bladder may be acutely inflamed (*cystitis*), the inflammation originating in the mucous membrane, and being extended to the muscular and serous coverings. It is caused by calculi, irritant drugs, retention, surgical operations, and external injuries, and the Peritonitis may be partial or general.

Hystitis is very rarely observed in the unimpregnated uterus; it may come on after menorrhagia by sudden suppression of the catamenia, long walks, wet and cold, and I have known it induced by the incautious use of topical applications. It is most frequent after delivery, and the fundus is the part mostly first affected. When the peritoneal investment becomes implicated the disease often assumes an alarming character. *Ovaritis* may be presented in one or both the ovaries without the uterus being inflamed; in the larger number of examples, however, it is the complication of general Peritonitis or antecedent uterine inflammation. Deep-seated pain in one or both of the pelvic cavities indicates the lesion, and when the peritoneum is affected the pain becomes exceedingly acute, and an aching, wearying sensation extends down into the groins and thighs. There is often frequent desire to micturate, and when the disease is continued to the posterior portion of the peritoneum the rectum is rendered irritable, and there is constant inclination to evacuate the bowels. Puffiness or swelling is sometimes seen over the ovarian region, and that part is most painful on the least pressure, and the sickness and vomiting are often distressing.

The comparatively recent establishment of that great surgical operation *ovariotomy*, more especially as practised in this country, has proved that the peritoneal sac can be laid open, and its inner surface exposed over a great extent, and for a considerable time, without the production of such fatal results as it was formerly believed would inevitably follow. It now appears, from a large accumulation of cases, that in a healthy subject, and especially in the unilocular tumor, and when there are no attachments, the peritoneum may be cut, and freely, without the consequent inflammation being always formidable.

There are some other affections with which Peritonitis is occasionally complicated. In pericarditis and pleuro-pneumonia it sometimes happens that the inflammation spreads to the peritoneum: but in such instances it is often extremely probable that a contaminated state of the circulatory fluids constitutes the predisposing cause, and that the irritation existent in one of the great cavities is readily transferred to another, and that an adjacent membrane of similar structure, and under general predisponent circumstances, will take on the same morbid action. And, conversely, we know that Peritonitis often extends to the pleura, and it is not uncommon, as I have lately seen, to find hepatitis associated with dulness, moist crepitation, and all the other physical signs significant of inflammation in the lower third of the right thorax; and when the spleen is greatly enlarged, or in acute splenitis, the same conditions obtain at the base of the left lung; pressure and the proximity of like structures being the cause of such extension. In empyema the diaphragm may be rendered convex towards the abdomen, pushing down the abdominal organs, and friction and pressure induce Peritonitis; and in the enlargement of the liver or spleen, or an encysted kidney, or an ovarian tumor, this partition may be thrust up so abnormally into the chest as to press upon and excite the pleuro-pulmonary tissues to active inflammation.

Morbid Anatomy.—The morbid appearances of Peritonitis are very various, being modified by a number of circumstances; such as the type, the primary or secondary character of the attack, the condition of the blood, the amount and kind of disease in the viscera, and more especially of the solid organs.

Before speaking of inflammatory change, it may be observed that serous membranes may be simply congested, presenting a condition analogous but not amounting to inflammation, and this hyperemic state may be transient, temporary, or long-continued. When often returning or for some time existent it may give rise to excess of secretion, which is chiefly serous; nevertheless it may contain some coagulable matters, but their amount will be dependent upon the increase or diminution of the fibrinous and albuminous constituents in the blood. Such abnormal afflux of blood to this membrane may subside spontaneously, or there may be hemorrhage into the sac, and such hemorrhage may be passive or active,—it may

be by transudation or rupture. Exhalation into the peritoneal cavity sometimes occurs, when a sanguinolent serum and an injected membrane are discovered. In visceral laceration considerable collections of blood of course may follow.

The gases generated in the cavity of the peritoneum are sometimes in great amount; they are in nearly all instances the result of cadaveric change and the decomposition of the secretions. In empyema, gases are produced when there is no solution of continuity in the pleura, and the same may result when there is pus in the abdomen and the peritoneum has maintained its integrity; but they may have their origin in ulceration of the intestines, or traumatic injury.

The first inflammatory change in the peritoneum is the loss of transparency and of that shining polished appearance proper to its healthy structure. This dulness or opacity is accompanied by diminution of the lubricating secretion, and Baillie, Bichat, and Knox affirm that the membrane becomes dry. But such dryness is more apparent than real, because when handled it feels moist and unctuous. The sub-serous vessels become injected, and may be seen through the fine membrane in hair-like streaks, arborescent and ramified, or in a confused network, and when much crowded a velvety appearance is imparted. The degree or shade of redness depends upon the period of congestion, the kind of inflammation, and the condition of the blood. When the hyperæmia has for some time continued, or in sthenic inflammation, the hue is light red; when the congestion is but recent, or the inflammation of asthenic type, the color is less vivid and may be darker and venoid.

With the progress of the disease, vessels in the membrane which were colorless enlarge so as to admit red-blood globules. At various points small sub-serous sanguineous effusions are seen in the shape of bloody puncta; sometimes these are so numerous as to exhibit a spotted or speckled appearance, or they may coalesce and form red configurated patches of various sizes. I have said that at the first there is diminution of the lubricating fluid. In the course of a short time (at periods differing according to certain conditions which obtain, such as the mildness or severity of the attack, the general powers of the system, and the like) this secretion is re-established, and if the malady end in resolution it manifests all the characteristics of the natural state; but if the complaint progress it is augmented in quantity and altered in quality. The free surface of the peritoneum is then bathed with a semi-transparent homogeneous fluid, and the sub-peritoneal tissue is surcharged with a sero-albuminous secretion, and frequently the peritoneum proper can be stripped off with undue facility. This infiltration, however, at length permeates the serous tunic, when it and the filamentous layer become so confounded that it is not easy to trace the line of union. Under such circumstances the membrane is not only rendered opaque, but it looks thick and tumefied, and if carefully examined it feels rough, has lost it lubricity, and close inspection detects a viscid albuminous deposit varying in thickness according to the duration and severity of the attack.

The new or morbid secretion which is effused soon separates into two distinct forms, — a thin and watery whey-like fluid, and a thick gelatinous, pulpy, or more solid portion; the former constituting serum, the latter coagulable lymph, or, as it is otherwise named, albuminous exudation or plasma. The relative proportions of the fluid and more solid parts vary in each individual instance. Sometimes we find no serum whatever, and sometimes the effusion consists almost entirely of serum, the only traces of the albuminous exudate being minute flocculi floating in the fluid and rendering it turbid. In the inflammation of metastasis and low types of Peritonitis the effusion is sometimes puriform, or absolutely purulent. In acute sthenic Peritonitis the lymphic deposit is great. It is thrown down on the free surface of the sac in various amounts according to the condition of the circulation and the violence of the inflammation. It may be a mere film or in a layer several lines in thickness. It differs in color, being sometimes of grayish red, but is more frequently of a yellowish straw color. When abundant, it lies in smooth or corrugated plates; it is also found in honeycomb arrangement, in bands or bridles constituting bonds of union of varying thickness uniting the viscera, or it may be encircling the gut; it is generally seen in masses filling up the interspaces, and when lying between the intestinal folds it assumes an ill-defined prismatic configuration. The viscera are not only glued and matted together, but there is mostly more or less of adhesion to the parietal peritoneum. When a portion of the adventitious stratum is detached from the peritoneum, the coherent surface of the new product exhibits an irregular villous character, and it is speckled with small bloody puncta produced by torn capillaries, and the sub-serous tissue is ecchymosed. The new formation being at first villous, becomes smooth and more dense, and at length assumes a structure and qualities analogous to the true peritoneum.

If the exudation be submitted to the microscope new vessels are seen to per-

meate its substance, and more especially in the central portions. That they are connections or prolongations of the peritoneal capillaries is beyond dispute, although we cannot always trace their continuous structure. It was believed by Hodgkin[1] that new vascular extensions are carried out into the exudation, and that subsequently towards the peritoneum they contract and become nearly or quite invisible. This author is of opinion that the delicate parietes of the extreme vessels give way, that minute quantities of blood are received into the exudation, and that such are the first beginnings of those minute cavities which are destined to become vascular.

It is quite evident that the plastic effusion is an irritant to the serous surface, because when deposited on one part of the peritoneum, and any other opposing part comes in contact with it, such readily takes on the inflamed condition; hence it becomes explicable, in one way at least, why Peritonitis is so liable to diffusion. According to the time which elapses after its production, and the vital powers of the organism, is the degree or completeness of the organization. From being a semi-fluid gelatinous substance it becomes more dense and solidified, the capillaries are more numerous, it contracts in bulk, its filamentous texture is more defined, and it enters into firmer and more intimate union with the organs or parts it covers or connects. When there is much motion, it is sometimes disposed in a stringy or reticulated manner, and meshes are formed, filled with transparent fluid. Another morbid condition associated with these false membranes is that of serum or seropurulent fluid being collected between the peritoneum and the false formation, until the latter is raised up and loosened from its attachments and set free in the sac. When these adventitious membranes remain firm and adherent, the original serous membrane beneath them disappears, and their surface assumes the characteristics of a veritable serous membrane, and it is difficult to distinguish the new from the old. The former secretes a lubricating serum, is influenced by the same kinds of irritation, is liable to become inflamed, and in its turn to throw out true inflammatory products.

The attachments effected by these formations may subsist through the remainder of life. They may be protective and conservative. In the suppurative stages, when abscess forms in the solid viscera, this adhesive inflammation is the method which nature observes for the harmless exit of pus. These bonds of union may continue with little or no inconvenience. By the lapse of time they become thin and contracted, and when health is re-established and the absorbents are active, they may partly or wholly disappear. Absorption begins with the subsidence of the inflammation, and, as Rokitansky[1] remarks, it must, as a matter of course, be influenced by the thickness, that is to say the permeability, of the deposit.

Before the time of the two Hunters it was not by pathologists generally allowed that serous membranes secreted pus without solution of continuity; in other words, without the presence of ulceration. Since then this fact has been universally acknowledged. It may be secreted from the inflamed peritoneum, or from the surface of those adventitious membranes which are formed in the cavity. William Hunter says it is generally thinner than that of an abscess, and the containing surface is more or less covered with a glutinous concretion or slough of the same color as the fluid, in some parts adhering very loosely, in others so firmly that it can hardly be rubbed off, but still the surface covered with these sloughs is without ulceration or loss of substance.[2] Dupuytren and Villerme believe that the false membranes are concrete pus, and Rokitansky is of opinion that pus, under some inherent peculiarity, is a degeneration of plastic exudation. It is more frequently seen in the asthenic, subacute, and lower types of the complaint than in the sthenic. In the inflammation of metastasis, when the blood is contaminated, in parturient women, and in children, it is most common. The fluid may be puriform, purulent, or sanious. It may be yellowish green, or brown, or reddish. The peritoneum and subperitoneal tissue are much injected, and there is usually great infiltration of the tissues. In some instances it appears as if exuding from the entire inner surface of the peritoneum; in other cases it is associated with adhesions, and is discovered in distinct collections, bounded by organized septa, and resembling separate abscesses. It may be evacuated by ulcerative absorption through the abdominal parietes; by the same process it may pass into the digestive tube, the bladder, or vagina, or through the diaphragm into the thoracic cavity, or effect an entrance into the bronchi, or it may find a way of escape by the psoas muscle.

The pressure exerted by purulent collections is doubtless the main cause of ulceration commencing, but Craigie believes that in these cases sometimes ulceration may result without pressure, being merely the directly and obvious effect of inflammation. My colleague at the Tunbridge

[1] Lectures on Serous and Mucous Membranes.

[1] Pathological Anat., Syd. Soc.

[2] Medical Inquiries and Observations, vol. ii. p. 61.

Wells Infirmary, Mr. Marsack made (Sept. 18, 1865) an autopsy on the body of a young woman, on whom he had six weeks previously performed ovariotomy. The coils of the ileum were welded together, and joined to the abdominal walls by organized adhesions. Between the layers of the great omentum were small independent abscesses of creamy pus. In the lumbar region was a bounded abscess-like collection which contained half a pint of pus. At the sigmoid flexure ulcerative perforation was discovered.[1] Pressure, caused by a collection of purulent fluid, had been followed by ulcerative absorption of the tunics of the large bowel. When this secretion is effused in small quantity it may be absorbed, but if in large quantity and without opening, irritative fever is induced, the symptoms of pyæmia supervene, and it is then uniformly fatal. Sometimes adhesive inflammation in Peritonitis gives rise to very peculiar pathological conditions. The stomach and transverse colon have, in several instances, been glued together, and ulcerative absorption has effected a communication between them, so that the fecal contents of the large bowel have passed into the gastric cavity, and thence been expelled by vomiting. Two or more coils of the ileum may be soldered together, and an intercommunicating passage established in the same manner. In such examples the disease has generally become chronic.

In the partial or localized forms of acute Peritonitis, when some foregoing visceral disease has extended through to the serous coat, and instituted inflammation in that tunic, we not infrequently see circumscribed depositions of lymph cementing neighboring parts together while the remaining extent of the peritoneum is perfectly healthy. In hepatitis, when the convex surface is inflamed, strong adhesion is sometimes discovered. The spleen is in like manner united to the concave surface of the diaphragm, and the accretion may have assumed a cartilaginous or ossific character, the latter conversion being in that situation more frequently seen than in any other part of the abdomen. In simple ulceration of the stomach sometimes adhesive ulceration averts a fatal catastrophe by agglutination to one of the solid organs, or, as it has been repeatedly witnessed, by the production of an aperture into the colon, or sometimes into the duodenum; and, in a few rare instances, a canulous opening has been spontaneously made through the abdominal parietes, forming a gastric fistula. In malignant disease of this organ, most frequently seen at the pyloric end, there is much soldering together of the adjacent parts; the peritoneum is opaque and vascular, and the sub-serous tissue is greatly injected and infiltrated not only with carcinomatous deposit, but also with serous fluid. The duodenum, as before remarked, occasionally exhibits partial Peritonitis from rupture, consequent upon ulceration of the mucous and muscular coats, as the result of extensive burns, but its serous investment is more frequently inflamed from the irritation and pressure resulting from cancer of the head of the pancreas. When the jejunum is found morbid it is almost always in connection with the lesion of other organs. With regard to the ileum, what has above been said relative to the perforation of its peritoneal covering was descriptive of its morbid appearances. In phthisis sometimes protracted colliquative diarrhœa gives rise to ulceration in its mucous surface, but perforation in phthisis is exceedingly rare; it is, however, in this complaint occasionally beheld on or near the vermiform appendix. In chronic dysentery the colon may give way, and in such instances there is great destruction of the other tunics proper to the bowel. Such examples occur in those who have died after long residence in tropical climates, and in association with some form of hepatic disease—very generally with abscess of the liver.

In puerperal Peritonitis, according to Dr. Lee, the appearances of inflammation are sometimes confined to the uterus, but they are much more generally extended to other organs. The lymph is mostly thrown out in thicker masses upon the uterus than in any other situation, and this viscus seems to suffer in the greatest degree. In the sub-serous cellular tissue serum and pus are often deposited. The cellular tissue surrounding the vessels of the uterus where they enter and quit the organ, and that connecting the muscular fibres, is often surcharged with serum and purulent fluid.[1] The peritoneum becomes thick and vascular, more especially where it invests the uterus and pelvic viscera, and sometimes, when the malady is intense, the serum is mixed with blood, and pus is found in the pelvis. When death has rapidly followed, the lymphic exudate is semi-fluid, or the surfaces which have become agglutinated are readily torn asunder. The Fallopian tubes and ovaries are sometimes filled with pus or blood.

In the Peritonitis of children the abdominal viscera are found matted together and adherent to the abdominal walls. In some cases the viscera are covered with a thin grayish opaque covering, which feels soft and unctuous, and a turbid, reddish serum in which small

[1] Mr. Marsack's Hosp. Case Book.

[1] More Important Diseases of Women, p. 24.

flocculi are floating is effused in varying quantity. In that strumous affection which, according to Gregory, gives rise to Peritonitis, pus is secreted. And this physician asserts that sometimes the abdominal cavity will be abolished, the viscera being united in one mass, and everywhere adherent to the parietal peritoneum, the latter in all its duplications being thickened, and the soldered intestinal convolutions inter-communicating.[1] When the peritoneum becomes inflamed consecutively after scarlet fever, measles, rheumatism, or some other fever, an excess of serous effusion is discovered, the albuminous portion being inconsiderable or almost absent. The fluid is of whitish straw-color or of dirtyish red.

DIAGNOSIS.—The more severe forms of acute Peritonitis are fully expressed, and the disease cannot well be mistaken; but in the subacute and more partial descriptions, when the disease is not a primary but secondary complaint, or a complication, it may be so masked, mixed up, and confounded with the symptoms of other morbid changes as to render the diagnosis very difficult. In all instances the physician should pay marked attention to the history of the case, as well as to the objective and subjective symptoms, because there are affections which when superficially reviewed simulate this complaint, and it has not infrequently happened that the ignorant or off-hand practitioner has fallen into grave error. The diseases which it most resembles are gastritis, enteritis, colic, rheumatism, neuralgia, hysteria, obstruction of the gall-ducts, renal calculus, and lead-poisoning. With respect to *gastritis*, it is in this country, as I have before observed, rarely or never met with as a purely idiopathic affection. Abercrombie means by this term inflammation of the mucous membrane, and it is in such sense that it is now employed. When the mucous coat takes on this morbid state there may be pain on deep pressure, the sickness is urgent, the thirst distressing, and fluids are constantly ejected. It can almost always be traced to some exciting cause. In Peritonitis there is more difficulty in the etiological conclusion, and in the latter the pulse is smaller and more wiry. The inflammation may commence in the digestive surface and extend to the peritoneal investment, and it then, of course, becomes partial Peritonitis. It occasionally occurs when the gastric portion of the peritoneum is roughened by lymphatic exudations that auscultation can detect some friction sound; but this, however, is seldom heard. In the great majority of cases gastritis is referable to acrid and corrosive poisons. Haller knew it produced by the patient having taken cold water when he was heated. It is frequently very difficult, often absolutely impossible, to diagnose Peritonitis from *enteritis*. Inflammation may begin in the mucous membrane and implicate the peritoneum, or Peritonitis may at length involve all the coats of the bowel, when both diseases obtain. The vomiting is more urgent in enteritis, the bowels are often obstinately obstructed, and gangrene is sometimes the result. The pulse is of better volume than in Peritonitis, and as the rule the patient does not complain of so much pain. In Peritonitis, partly owing to the involution of the parietal peritoneum, the pain on pressure is more acute and superficial, the patient is more averse from motion, the respiration is more thoracic, and the features are more collapsed.

In *colic*, which may be from simple flatulence, the pain and distension may be severe, and even the face may be an index of suffering. When there is very great distension, pressure may increase the pain, but more commonly pressure relieves rather than augments it; the circulation is little if at all affected, and there is no symptomatic fever. Frequently constipation and vomiting are associated with other symptoms; the patient complains of a twisting, wringing pain at the umbilicus, which comes on paroxysmally, and there are intervals when the suffering is inconsiderable or absent. This condition of colic is, when regarded alone and as simple colic, not an important affection, but it sometimes comes on as the herald of a more grave disease, and ends by the development of inflammatory symptoms. In *colica pictonum* there is no apparent obstruction of the bowels, although there are the common symptoms of ordinary colic. There are constipation and abdominal pain, even violent pain—*dolor atrox*—but there are other symptoms, such as pain in the head and limbs, a blue, leaden line in the gums, and loss of power in the hands and forearms, and the patient is either a painter, or investigation discovers that he has in some way been subjected to lead poisoning. The abdominal muscles in *rheumatism* sometimes are rendered so excessively painful that moderate pressure causes great suffering, and notwithstanding that examples are occasionally observed in which acute Peritonitis has thus supervened, yet such instances are very exceptional, and ordinary observation will generally prevent any mistake in diagnosis. Negative facts will be our chief guide. In such cases the circulation is little affected, the pulse is large and full but not frequent, sickness and vomiting are not present, the countenance has not

[1] Medico-Chirurg. Transactions, vol. xi. p. 266.

the pinched, anxious expression which it assumes when the peritoneum is inflamed, and if the abdomen be carefully examined the tenderness will be found more severe at the origins and insertions of the muscles; lastly, it will be shown upon inquiry and examination that rheumatism has recently obtained, or that its symptoms are still present in other parts of the body.

Neuralgia is another affection which mimics Peritonitis. The pain is described as a tight girdle or ligature passing round the body, and imparting a feeling of constriction; it traverses the course of the genito-crural nerve, percussion on the spinal processes detects some tenderness, and the legs and genito-urinary organs are often more or less affected; again, there is the absence of tympanites, pain on pressure, quick pulse, facial collapse, and other phenomena so expressive of Peritonitis, and which I have in detail described above. In that protean malady *hysteria*, which mocks this as it simulates so many other affections, the patient is apt to complain of increased pain almost before the hand has really touched the abdomen, and when it does touch it, the pressure does not, as in Peritonitis, augment it. The pulse is natural, the tongue clean, and the countenance does not bear the impress of severe and acute disease. The breathing is not thoracic, the legs can be extended, the decubitus is not dorsal, and borborygmi and intestinal flatulence are often present; again, upon inquiry, it will not infrequently be found that large quantities of pale or colorless urine have been voided, that the uterine functions are at fault, or that some ill-defined spinal symptoms obtain. A comparison of the leading features common to the two affections will leave but little doubt as to the true nature of the ailment.

In *obstruction of the gall-ducts* from calculi, inspissated gall, tumors, spasm, and other causes, the pain is paroxysmal, often excruciating; and with the passage of the obstructing body, and the restored patency of the canal, the suffering at once subsides. There is no pyrexia, the heart's action is little or not at all accelerated, nor is there distension or abdominal tenderness. In addition to such negative there are positive facts; the symptoms of biliary disturbance are mostly present, the alvine dejections are often light-colored, the urine is dark and porter-like, the conjunctivæ are yellow, the skin is tawny, and the pain is localized beneath the margin of the right false ribs. In *renal calculus* the pain radiates from the back round to the abdomen, it comes on suddenly, courses down the direction of the ureters, in the male produces retraction of the testicle of the same side, and shoots down the thigh, when for a shorter or longer interval it declines or entirely subsides, and bloody urine is a common accompaniment.

In puerperal Peritonitis the *after-pains* are associated with contracted, not relaxed uterus, which is the fact in Peritonitis; they gradually diminish, and in thirty or forty hours have become much less in force and frequency. Inflammation of the peritoneum commences at the ordinary date of the after-pains' decline. The remedial agents which relieve hysteralgia do not arrest acute Peritonitis. *Ephemeral fever* is distinguished by its brevity, its milder aspect, by the mammæ remaining of normal size, and those serious conditions which mark the advent of an inflamed peritoneum are wanting. Lastly, in speaking of the diagnosis of this affection, it must be borne in mind that under grave cerebral disease, when nervous sensibility is obtunded, the peritonitic symptoms may be rendered very obscure, and under such conditions diagnosis may be impossible.

Prognosis.—The opinion to be arrived at relative to the result of this disease will be modified and determined by a variety of considerations, and in every case a different array of facts will be presented, all the bearings of which should be carefully scanned. The asthenic is less auspicious than the sthenic type, and when it is the inflammation of metastasis the chances of recovery are less. In *unfavorable* cases, in despite of the best-ordered means of treatment, there is a progressive aggravation of all the cardinal symptoms; the pain does not decline, nor do the distension and the tenderness abate; the breathing is more hurried, shallower, and entirely thoracic, the pulse becomes thready and intermittent, the sickness is excessive, the bowels are generally confined, distressing singultus supervenes, the surface becomes cool, is clammy and relaxed, the legs and feet are cold, the patient falls down in bed with knees drawn up, lies on his back, the Hippocratic countenance is more marked, and often the mind is clear to the end. He sinks by asthenia. In those instances when we can prognosticate a *favorable* termination, there is remission of pain and tenderness, decline of the distension, the sickness comes on at longer intervals, and at length abates; the pulse is slower and fuller, the temperature of the body equable and warm, the respiration is not so quick, and the diaphragm descends lower down, and the patient can turn on his side. When we have reason to believe that there is perforation of the bowel, rupture of the liver or spleen, the urinary or gall-bladder; when we suspect the evacuation of an abscess or the effu-

sion of blood, our prognosis must be unfavorable, and recovery under such conditions is well-nigh hopeless. In the consecutive form, when the strength has been undermined by a previous malady, the probabilities of a fatal issue are great. In puerperal Peritonitis antecedent hemorrhage and the amount of exhaustion induced by parturient efforts would influence our decision.

TREATMENT. — In every example of acute peritoneal inflammation, the remedies should be prescribed with a just reference to the emergencies of each particular case, because no trite and exact rules can be given admissible of universal application. The date of the disease, the powers of the patient, the kind of pathologic action going on, and the antecedent circumstances so far as they can be ascertained, in conjunction with other facts, must needs modify our resources, and be suggestive in the selection of those agents which are accounted as the most effective auxiliaries in combating the affection. That this disease, like many other ailments, when seen at the outset, and treated according to science and experience, can be guided and carried to a successful termination is of such every-day proof as not to require being insisted upon here. And on the other hand, if its progress be unrestrained by ignorance or timidity, it soon passes beyond the control of the most vigorous handling and the nicest skill. It is eminently one of those complaints which does not admit of vacillation and delay, promptitude and decision of purpose being of paramount importance.

In an acute attack of inflammation of the sthenic type, in the strong and hitherto healthy, and especially those who have lived in the pure air of the country, our best ally is *blood-letting;* but it is by far the most successful when performed at the commencement of the malady — as soon as possible after the pulse has become hard and quick, the pain urgent, and the disease established. It is then, by making a decided impression upon the circulating organs, that there is the greatest chance of the inflammatory action being cut short, and of those morbid processes being arrested which so quickly follow the development of the affection. Nor should we be deterred from the use of the lancet by the mere *smallness* of the pulse, because it may feel constricted, hard, sharp, wiry under the finger. for with the free emission of blood it will increase in volume and become soft and more natural to the touch. Many authorities, and some of high reputation, have spoken of the number of ounces which ought to be drawn at a first, second, or even third depletion, but there is no just rule as regards quantity. One patient will bear a much greater loss of blood than another, even when the two cases seem to bear a close resemblance. Our real and only reliable guide must be the effect produced by the abstraction. An influence must be made upon the heart's action, and the patient should, if possible, be bled in the erect position. Abercrombie recommends one or two small bleedings at short intervals after the first in order to keep up the good results of the primary depletion. There is no doubt if ten or a dozen hours are allowed to elapse after the first use of the lancet, and before a second visit, that in such long interval the pulse may recover its strength, the initiatory symptoms in full force return, and a large quantity of blood will require to be lost. In a disease so perilous the patient should at the outset be seen every two or three, or at least every three or four hours. It is within the first twenty-four hours that blood-letting is of the most avail. When effusion has set in and progressed to some extent, blood-letting is more likely to be harmful than useful. In the young and the robust, in those of ruddy complexion and high arterial action, and those who live in the purer air of the country, bleeding is much better borne, and it may need to be repeated. The dwellers in urban communities, especially amongst the badly nourished and ill clad, such as present themselves at the hospitals of the metropolitan cities and large towns, very rarely, if ever, require general blood-letting, and when it is had recourse to, a smaller quantity is followed by the desired effect.

After the lancet has been used it is excellent practice to follow it up by *local depletion.* Cupping is of course, from the pressure it would give, inapplicable; but twenty, thirty, or even forty leeches at one time may be applied to the abdomen, and often with the greatest benefit. Fomentations, by means of flannels immersed in hot water, and wrung out as dry as possible, the heat and moisture being kept up by their being covered with a large piece of oiled silk, is good treatment, and the flow of blood can thus for some time be promoted; or a large linseed-meal-and-bread poultice, or a bran poultice, produces a soothing effect. In the use of these applications, however, care should be taken to constantly renew them before they become cool, and when they are discontinued a dry hot flannel of three or four folds should be placed upon the abdomen. Another very valuable mode of treatment at this juncture is the employment of terebinthinate epithems. Two or three dessertspoonfuls of the spirits of turpentine may be sprinkled over the wet flannel, or a large piece of spongiopiline the size of the abdomen may be

wrung out of hot water, and the turpentine in like manner sprinkled over it; and these may be repeated two or three times if the patient can endure the applications. I can bear testimony to the very excellent effects of the external use of turpentine, which I have very frequently in this mode recommended, and I believe it to be a most valuable remedy.

The late Dr. Sutton of Greenwich was the advocate of cold applications in abdominal inflammation. He used cold enemata, and cold cloths made wet with evaporating lotions, and, as he asserted, with great benefit. Abercrombie also recommends this method of treatment. "In a considerable number of cases," says this physician, "I have used with evident advantage the application of cold by covering the abdomen with cloths wet with vinegar and water, or even iced water. Injections of iced water have been proposed, and I think it probable might be used with advantage."[1] M. Smoler of Prague has recommended cold compresses often renewed, and laid on the abdomen, their application being desisted from as soon as the patient sleeps; but he never allows the patient to change them with his own hands.[2] Not having any personal experience of cold appliances, I shall therefore not do more than mention a remedy to the success or otherwise of which I can bear no testimony. It would to myself at least seem of doubtful utility in many cases, and one involving great risk in others, and I prefer what I believe to be equally efficacious, and certainly safer, namely, warm fomentations.

After the abstraction of blood a large dose of *opium* should at once be administered, and two or three grains may be given in urgent cases. It then not unfrequently happens that the patient has a tranquil sleep, after which he awakes with less pain, a moister skin, and with remission of the symptoms generally. In those instances in which sickness and vomiting from time to time come on, opium acts more beneficially. If we wish to influence the system by mercurials, one grain of opium and three grains of calomel may be taken every four or six hours, and mercurial frictions on the thighs and in the axillæ can at the same time be adopted by means of the linimentum hydrargyri, which is perhaps the most convenient preparation for this purpose; or two grains of calomel and half a grain of opium may be given every second hour, and the inunction being also used until some slight effect be produced on the gums. Another mode of administering opium, especially when the stomach is irritable and ingesta are rejected, is by enemata. Thirty or forty drops of laudanum can be injected in two or three ounces of starch gruel, and such repeated according to the exigencies of the case. If the bowels should be loose and the rectum inclined to expel its contents, a suppository, composed of a couple of grains of solid opium with a sufficient quantity of Castile soap or cocoa-nut butter to form a conical mass, may be introduced *per anum*, and such from time to time as the physician may deem desirable. The indications denoting benefit having accrued from the above-named remedies will be mitigation of pain, softer and fuller pulse, easier and slower breathing, more relaxed skin, and diminution of the abdominal distension; the face, too, will look calmer and more natural, and the patient probably give expression to a more comfortable feeling.

Vesication is another of our aids in guiding the malady to a favorable issue. It may be done by means of the ordinary emplastrum lyttæ or by the acetum cantharidis, or the liquor epispasticus, which are considered to act with more celerity. A large blister has sometimes appeared to be of service, but vesicants should not be applied at the outset of the attack. They are most advantageous when the initiatory symptoms are on the decline, when there is not such high arterial action, and when the surface has become cooler. I have seen them do harm when applied too early. The blistered part may afterwards be dressed with savin ointment, by which means a modified and beneficial amount of counter-irritation can be continued.

When the stomach is so irritable that scarcely anything can be retained, *hydrocyanic acid* in an aqueous mixture, with a little glycerine or mucilage added, is one of the best of remedies. *Effervescing draughts* with the bicarbonate of potash and citric acid are sometimes given, but the evolution of carbonic acid gas by distending the organ makes it contract upon itself, and the contents are again pumped up. There is another objection to their use; as tympanites always in greater or less degree obtains, the distension of the stomach pushes up the diaphragm still higher, and renders the respiration more difficult; and, again, the neutral salt which is formed, by acting as an aperient, is liable to increase the peristaltic action of the bowels, a result which should be most sedulously avoided. When the tympany is very considerable a *fetid injection* consisting of two drachms of the tincture of assafœtida in half a pint or a pint of decoction of pearl-barley may be administered; or an ounce of the oil of turpentine, first being made into an emulsion with the yolk of egg and then mixed with the same quantity of barley decoc-

[1] Pathological and Practical Researches, 3d edit. p. 173.

[2] Betz's Memorabilien, and Gaz. Med. Lyon, Nov. 16, 1865.

tion as before mentioned, can be injected. The oil of turpentine taken in doses of ten or fifteen drops in some emulsion or bland drink, or five or eight grains of the compound galbanum pill, every six or eight hours, are good measures for adoption. When such do not produce the desired effect, O'Beirne's long elastic tube may be introduced high up into the bowel and there allowed to remain, by which means incarcerated gases find a ready way of escape and much comfort is experienced. It is when this condition of tympanites subsists, and gives great distress after the inflammation has ceased, that such measures are useful. When we do not feel certain that the inflammatory action has subsided, and when vesication has not removed the cuticle, terebinthinate embrocations are likely to be of service.

Constipation is another circumstance which in these cases generally obtains. A right and rational consideration of this matter is of cardinal importance, because the very wrong notion is sometimes entertained that the bowels must be moved, and under this erroneous reasoning drastic purgatives have been given, producing, as they were said to do, much mischief. The physician should bear in mind that the constipation is not the cause but often the *effect* of the inflammation, and that the indicated mode of procedure is first to subdue the inflammatory action, when in due time restoration of function will follow. To allay and mitigate peristaltic action—in other words to give rest to the parts in a state of lesion—is to carry out the same principle observed in enjoining the disuse of a torn muscle, and in peremptorily excluding light in the treatment of an inflamed eye. If it is believed that there is great accumulation in the colon, an enema with olive oil and half an ounce of the spirits of turpentine in decoction of barley may be administered by means of the O'Beirne tube, and such may be repeated if deemed necessary; but there is benefit in frequently having recourse to this remedy in order to keep up gentle action of the intestines. To give purgatives by the mouth is often to set up or augment the irritation in the gastric mucous membrane, and by increasing the peristaltic action in the bowels to aggravate the disease. The contents of the intestines are often but soft and pasty matters, and then their presence can do no harm. There is a far greater liability to error in being too solicitous respecting the movement of the bowels than in leaving them to the efforts of nature.

Diaphoretic and *diuretic* medicines are to be used with the foregoing. The acetate liquor of ammonia, the ethereal spirits of nitre with camphor julep, form a good mixture, and tend to keep the skin and kidneys in the performance of their functions. Small quantities of strong beef-tea or farinaceous food are to be given at intervals. Smoler of Prague gives a little broth once or twice daily, and as little drink as possible while the activity of the disease continues. Urgent thirst may be allayed by pieces of ice being put into the mouth.

Such, then, is the line of treatment to be pursued in the *sthenic* or more flagrant forms of inflammation of the peritoneum, but they are not often met with, and constitute exceptions rather than the rule. It would be out of place here to enter upon that troubled question, the change of type in disease, but certain it is, whether from agencies operating from without, or from causes originating in the organism itself, that depletion in this disease is very rarely warrantable in the way in which I have described; nevertheless it would be wrong to pass into that extreme of inertness which has of late become but too prevalent, for, as I believe, moderate blood-letting in rightly selected cases is yet, despite the conflictions of controversy and the caprice of fashion, a valuable remedy.

As observed, by far the greater number of cases of Peritonitis presented to our notice are of the *asthenic* type—in that adynamic state of the system that will not bear lowering, and in which the general strength should be husbanded, not destroyed: for instance, in such examples as are consecutive upon or the sequels of some foregoing malady, when following the eruptive fevers, when metastatic of erysipelas, when the complication of albuminuria, when it occurs in perforation of the bowel in enteric fever, in the bursting of a mesenteric gland, in phthisis abdominis, in those occult blood changes which affect general nutrition, as in cancer, struma, and the climacteric period, or cirrhosis and cardiac disease, and in contamination of the fluids, as in pyæmia and puerperal Peritonitis. When we have to treat it as related to such conditions, our remedial measures must be resolved upon with great modification. *Opium* in the asthenic form is the chief agent, and Drs. Graves and Stokes were among the first physicians who gave this drug very largely. An impression decided and speedy must be made upon the nervous and sanguiferous systems, and in such lies our main hope of arresting the disease. It should be given in larger doses, and the effect kept up in full and apparent manner, but not to the induction of narcotism. Two or three grains may at first be prescribed, and a grain every four, three, or even two hours afterwards. Some in very urgent cases give half a grain, or even a grain, every hour. But in these perilous attacks of illness the patient should be

frequently visited, and the physician should cautiously watch the effects of the remedy. Narcotism will be produced much sooner and with a far less dose in some persons than in others. If there be much sickness, laudanum injections should at short intervals be administered, instead of giving the drug by the mouth. In cases of great prostration and debility, quinine and camphor may be conjointed with the opium. In *perforation*, when the contents of the bowel are liable to be extruded into the serous cavity, and when lymph is thrown out, by which means the conservative attempts of nature are to seal up the orifice and mend the breach, to subdue and still the action of the part is everything. Motion implies the pouring out of the intestinal matters, the removal of the lymphic plug—in other words, a fatal issue. To paralyze the bowel for a time is the aim, in order that reparation may be favored. In these particular cases I would not give mercurials by the mouth. If they were to increase the flow of bile, and thus augment the peristaltic action, they would do incalculable harm. Inunction, as above recommended, might be used until the gums became slightly affected. It is far better to depend upon opium. In perforation there is sometimes very great tolerance of this drug. Murchison has known so large a quantity as sixty grains to be given in three days with impunity. In traumatic wounds, in the operation for hernia, and in paracentesis abdominis, the same kind of treatment should be followed. Fomentations, turpentine stoups, or a large poultice may at the same time be employed. Subsequently vesication may be ordered —and such repeated according to circumstances.

In that kind of Peritonitis complicated with Bright's disease, the primary complaint should be more regarded than the intercurrent affection. Salivation is to be carefully avoided; diaphoretics, warm cataplasms, rubefacients to the loins, warm baths, the hot-air bath, vesicants, and nutrients are then indicated. When the acute symptoms have subsided, the compound jalap powder and Dover's powder may be given. When the attack follows the exanthemata, is metastatic of erysipelas, or connected with pyæmia, mercury is inadmissible.

In *puerperal peritonitis* the treatment is often difficult and doubtful, and it should earnestly be borne in mind that it is frequently associated with or consecutive upon an altered or vitiated condition of the blood. If the power of the pulse warrant the lancet, bleeding, to be of benefit, should be done *early*. If deferred it is likely to do harm. The best authorities are emphatic on this point. Dr. Ferguson asserts that to be beneficial it must be employed within the first twenty-four hours, and that in the second stage of the disease it often produces a rapidly fatal result. Churchill is of opinion that when the remedy is admissible the time for its beneficial use is very limited, and he has seen no good from its employment after the first twenty-four hours. The first-named physician in doubtful cases gave ten grains of Dover's powder, and covered the abdomen with a linseed-meal poultice, which from its thickness would keep warm for four hours. At the expiration of that time, if the symptoms were not relieved, ten grains more of Dover's powder and another poultice were prescribed. If in other four hours from this second medication the malady did not yield, he had recourse to depletion. Sometimes when the pain is great and the pulse tolerably firm, two or three dozen leeches at once applied and followed by fomentations give good results. In the majority of cases, measures will be required which have previously been described as suitable to the asthenic type of this inflammation.

In the *Peritonitis of children* those general principles are to be aimed at which have already been given. It need scarcely, however, be more than mentioned here that these little patients always require their maladies to be managed with a gentle hand, and most especially in the use of depletion and opiates. These remedies with them are very uncertain in their effects, and sometimes produce a far greater impress upon the general powers than calculated upon by the practitioner. The age, the history of the case, and the cardinal signs will be our guide, and our measures should be modified according to the facts and exigencies of each particular instance. In the sthenic types, leeches, calomel, and if the age permit, carefully regulated doses of opium, linseed-meal poultices, terebinthinate epithems, warm baths, and injections are to be used. When the affection comes on as the sequel of one or other of the eruptive fevers, if we believe it to be traceable to some constitutional malady, some depravity of the organism, depletion and antiphlogistic means will be unwarrantable; then mercurial alteratives, small opiates, fomentations, warm baths, and counter-irritation will be the best measures. When the little patient tides over the more perilous days of active disease, and the case drifts onwards towards the more chronic condition, and when we find that there is effusion, counter-irritation and mild mercurial alteratives should be given, and during convalescence the iodide of potassium with decoction of sarsaparilla, the syrup of the iodide of iron, or quinine with the

tincture of the perchloride of iron, often produce excellent effects. In the strumous diathesis cod-liver oil may be prescribed.

It has in this article been previously pointed out to the reader that Peritonitis not seldom occurs in a partial manner, and as a *complication* arising in the course of some foregoing disease, as when an antecedent malady, first instituted in some organ or organs covered by the peritoneum, is at length extended to it. For instance in hepatitis, when the convex surface is the seat of lesion it remains circumscribed; or the inflammation may be extended through to the pleura, and pleuro-pneumonia result, as in a case which I recently witnessed. It is then quite clear that our remedies should be addressed to the viscera involved, as well as to the serous membrane. In acute splenitis the turgor of that viscus should be relieved, or it would be vain to try to mitigate the peritoneal symptoms, which have their origin in the stretched, tense, irritated condition of the capsular coverings. In the liver affection we should as soon as possible bring to bear the influence of mercurials; but in diseases of the spleen, mercurials are most improper and would do harm.[1] It is incontestable then that our diagnosis must be rightly formed, or our practice will be incorrect. In diarrhœa and dysentery, when associated with an inflamed peritoneum, it is needful at once to control the excessive action of the bowels, and when such is subdued, the irritation extended to the serous membrane is likely to be subdued also. Opiate enemata, fomentations, the compound ipecacuan powder, and counter-irritants are the best measures. It has been remarked that the right iliac fossa is often the seat of pain, the disease being located near the cæcum, and it sometimes happens that the impaction of indurated feces has much to do with setting up the inflammation. Large bland enemata, by unloading the great bowel, are in such cases of excellent service. When the sexual and urinary organs are first affected and Peritonitis becomes superadded, the primary disease should be held in view, and by its mitigation or removal the consecutive complaint will be benefited. From all, then, which has been said, it is obvious that in the treatment of every case the successful issue will greatly depend upon a clear and correct conception of the nature of the ailment, and a right interpretation of those symptoms which indicate the particular kind of morbid changes which obtain.

When the more acute stage has passed over, and those remedies suited to the earlier period of the attack have been employed, small doses of opium may still be given in combination with quinine or some of the bitter infusions. The various preparations of iron are of great value, and perhaps the tincture of the perchloride is the best. It is safest to defer as long as possible the use of aperients, and in preference the gentle action of the bowels should from time to time be promoted by bland enemata. When the active state of the affection has quite ended an occasional dose of gray powder with rhubarb and the bicarbonate of soda may be given. Terebinthinate and other stimulant embrocations can be applied to the abdomen when there is effusion, and a flannel bandage round the body, so as to insure moderate and well-regulated pressure, is another mode of favoring absorption.

The *diet and regimen* during convalescence are of great importance. At the first soups and farinaceous food are to be allowed, and for some time solids should be interdicted. Arrow-root, tapioca, the Indian corn-flour, with milk, are nourishing; and veal or chicken-broth with the crumb of bread may be given; and in the course of time beef-tea with toast, boiled chicken, and pounded meat may be taken. When stimulants are needed, sherry, weak brandy and water, claret, and bitter ale may be allowed. Flatulent vegetables and acescent fruits should for some time be discarded. An occasional warm bath to keep the skin in proper action is desirable. When the patient shall have so far recovered as to be able to travel, change of air will generally expedite his restoration to health.

[1] See art. on Diseases of the Spleen in this work, where I have expatiated on the ill effects of mercury on diseases of this organ.

TUBERCLE OF THE PERITONEUM.

By John Syer Bristowe, M.D., F.R.C.P.

Pathology.—The deposition of tubercular matter in connection with the peritoneal membrane is of very common occurrence. For generally in cases of tubercular ulceration of the bowels, and certainly in all those cases in which the ulceration is extensive, gray granulations may be found in greater or less abundance studding those areas of serous surface which correspond to the areas of mucous ulceration. But tubercular formations of this kind seldom show any tendency to spread, and are rarely productive of appreciable mischief. They are for the most part, indeed, purely local phenomena.

There are other cases, however, far less common yet still not infrequent, in which the tendency to the deposition of tubercle is general throughout the serous membrane, and in which ulceration of the bowel is evidently not the starting-point of the peritoneal affection, and indeed is often altogether absent. To these, which were formerly known as mere varieties of chronic peritonitis, the name of Tubercular Peritonitis is now very often given. They are characterized not only by the comparative severity and extent of the peritoneal affection, but also by the fact that the symptoms of this affection are usually well-pronounced, and sometimes indeed are paramount.

Tubercular Peritonitis, like tuberculosis generally, may occur at any age, but is probably most common in early life. Out of 48 cases extracted from the records, for a limited period, of St. Thomas's Hospital, 3 were under ten, 14 between ten and twenty, 13 between twenty and thirty, 9 between thirty and forty, 7 between forty and fifty, and 2 between fifty and sixty. But in correction of these figures it must be recollected that children under ten are admitted in small proportion into general hospitals. Out of the same number of cases, 26 were males, 22 females; but 222 tubercular males were admitted to 127 tubercular females, and proportionately to this number tubercular peritonitis was more frequent in the female than in the male, in the ratio of very nearly three to two. In two cases only was the tubercular deposit limited exclusively to the peritoneum. In all the others—namely, in 46 cases—there were tubercular deposits in other organs, and generally in several other organs. In 42 there was tubercle in the lungs; in 25, in the intestines; in 25, in the pleuræ; in 20, in the spleen; in 14, in the bronchial glands; in 11, in the kidneys; in 10, in the mesenteric glands; in 9, in the liver; in 8, in the brain; in 4, in the uterus and Fallopian tubes; and in 1, in the pericardium. But taking into consideration the relative frequency with which the several organs just enumerated are the seats of tubercle, a very different numerical relation than that just given becomes apparent between tuberculosis in them severally and tuberculosis of the peritoneum. Thus tubercular disease of the peritoneum was present in (to disregard fractions) 74 per cent. of cases of tubercle of the pleura, in 53 per cent. of cases of tubercle of the spleen, in 46 per cent. of cases of tubercle of the kidneys, in 44 per cent. of cases of tubercle of the brain and of the uterus and Fallopian tubes respectively, in 39 per cent. of cases of tubercle of the liver, in 37 per cent. of cases of tubercle of the bronchial glands, in 33 per cent. of cases of tubercle of the pericardium, in 29 per cent. of cases of tubercle of the mesenteric glands, and in 12 per cent. only of cases of tubercle of the lungs and of tubercle of the intestines severally. It may be worth while to add, that out of the 46 cases in which there was tubercular deposit in other organs besides the peritoneum, the most serious lesion was in 12 of the tubercular disease of the peritoneum; in 15, that in the lungs; in 8, that in the brain; in 3, that in the pleura; and in 1, that in the intestines.

Peritoneal tubercles present much the same characters as tubercles occurring in other parts. They are sometimes miliary, or in the form of minute roundish spots, varying from mere points up to the size of a poppy-seed, and having an opaque white, or grayish or yellowish aspect. Sometimes they form rounded or lobulated masses, from the size of a tare up to that of a hazel-nut, presenting for the most part an opaque buff color, studded often with black points or patches, and exhibiting a cheesy aspect and consistence which are modified by the more or less abundance of fibroid material which invests and permeates them. Sometimes again, but much more rarely, there are found, lying between organs which are adherent, tubercular laminæ of considerable thickness

and extent. Peritoneal tubercles exist rarely, if ever, independently of the effusion of lymph, and indeed rarely, if ever, are formed otherwise than in the substance of such adhesions, although they may subsequently in the progress of enlargement involve not only the peritoneum itself, but the tissues which are subjacent to the peritoneum. There is probably no essential distinction between the miliary form of tuberculosis and that in which the tubercles form masses of larger size: the former, however, are most frequently found in cases of acute progress, the latter in cases which are chronic; the former, moreover, are generally discovered thickly-set and innumerable, the latter in comparatively small numbers. In cases of miliary tuberculosis indeed, the peritoneal surface is mostly found covered with a layer, of various thickness, of grayish, transparent, adherent, and toughish lymph, which not only invests the abdominal organs, but renders them more or less adherent to one another. And in the substance of this lymph the tubercles are disseminated as opaque grains, which may be separated with the lymph from the subjacent peritoneal surface. This condition may be general, or it may be limited to certain regions, and not infrequently when thus limited the parts affected are studded with filaments of lymph, in which miliary tubercles may be recognized. In the other form of the disease, the peritoneal surface is covered with lymph which has assumed the form of connective tissue, and the adhesions between the organs are formed of tough fibrous bands. And it is in this tissue, and especially among these bands (sometimes forming flattened masses between closely united surfaces), that the large masses of tubercle are for the most part found. It is this form of tubercle which occasionally invades the intestinal walls, and leads to perforation of the bowel from without. In association with the deposition of peritoneal tubercle, the various accompaniments and sequelæ of common inflammation manifest themselves generally in a greater or less degree. Thus, there is often patchy and streaky redness, often fibrinous effusion which is not visibly tubercular, and often effusion of serum; sometimes there is suppuration, and sometimes again hemorrhage into the peritoneum. The most important of these, from its frequency, is undoubtedly the effusion of serum. Indeed tubercular disease of the peritoneum is a common cause of ascites. It is probable that most cases in which tubercle exists on the peritoneal surface prove fatal sooner or later, either from the direct effects of the peritoneal disease or from the effects of tuberculosis in other organs. Yet there can be no reasonable doubt that recovery sometimes takes place. For not only does our knowledge of the progress of tubercle in the lungs justify us in this inference, but we not infrequently meet with cases of recovery from symptoms which we have the strongest reasons to regard as dependent on tubercular peritonitis, and still more, we occasionally detect in the abdomens of persons dead of other diseases signs of old peritonitis, together with the presence of earthy nodules such as result from the drying up of tubercle.

Symptoms.—The symptoms which attend the progress of peritoneal tuberculosis present much variety, and are often vague and indefinite. Often, indeed, and not only in those cases in which the peritoneal affection is slight, or in those in which it is as it were overshadowed by the preponderance of disease in other parts, but in those cases even in which it is the predominant or sole affection, they fail to indicate clearly the peritoneum as the seat of any disease. Further, they are so generally complicated with the symptoms which are due to coexisting tubercular disease in other organs, especially in the lungs, pleuræ, and intestines, that it is impossible altogether to dissociate them from these latter.

Most cases, however, of tubercular peritonitis, in which there are obvious indications of abdominal disease, may be arranged, somewhat roughly perhaps, in two classes: the first, the acute class, in which the symptoms bear a considerable resemblance to those of enteric or of so-called "remittent" fever; the second, the chronic class, in which the symptoms correspond for the most part with those of "chronic peritonitis." In the acute form of the disease the patient sometimes in the midst of perfect health, more often, however, after some indefinite period of languor and loss of flesh and strength, begins to manifest febrile symptoms attended with remissions and indicated by heat and dryness of surface with quickened pulse, pains in the limbs and loins and head, diminution of the secretions, and perhaps drowsiness. At the same time the abdomen probably becomes somewhat hard and tumid and tender, and the patient complains of more or less pain in it. Generally also there is some disturbance of the digestive functions, dryness or furring of the tongue, thirst, loss of appetite, and nausea or sickness, with probably constipation or diarrhœa, or an alternation of these conditions. And with no material change in these symptoms, perhaps, beyond that which is due to gradually increasing debility and emaciation and the gradual supervention of what are ordinarily known as "typhoid symptoms," the patient gradually sinks

and at the end of a few weeks dies. The distinctions between acute abdominal tuberculosis and enteric fever consist, as regards the former disease, partly in the absence of rash, the less constant disturbance of the bowels, the non-limitation of tenderness to the cæcal region, and the less definite duration of the disease, and partly in the occasional presence of characteristic complications, among which may be enumerated tubercle in the brain, pulmonary phthisis, renal disease with albuminuria, and the accumulation of ascitic fluid. It may be remarked, however, that even in spite of care the cerebral symptoms arising from tubercle in the brain may be mistaken in some cases for the delirium of enteric fever, and the symptoms of pulmonary tuberculosis may pass for those of the pulmonary affections which so commonly ensue in that fever; and further, that the liability in both cases to intestinal perforation and acute peritonitic symptoms furnishes an element of serious difficulty in reference to diagnosis. In the chronic variety of peritoneal tuberculosis, the disease sometimes commences with more or less typical symptoms of acute peritonitis, sometimes creeps on with the utmost insidiousness; but in both cases (in the one after the disease has become fully established, in the other after the acute initial symptoms have subsided) the symptoms gradually become more or less identical with those which have been described elsewhere as indicative of chronic peritonitis: symptoms which, with many variations and remissions and exacerbations, may continue for a month or longer, and upon which in most cases sooner or later ascites supervenes. It must not be forgotten that in the chronic, as well as in the acute affection, deposition of tubercles in other organs is apt to take place, and that in its course the presence of tubercles in the brain, lungs, bowels, or elsewhere, may produce symptoms which may lead us or mislead us in our diagnosis; and that in this case, even more than in the other, there is liability to tubercular perforation of the bowel, and to lardaceous or other degenerative diseases of important organs, especially of the liver and the kidneys.

As examples of some of the many anomalous cases which do not by their symptoms fall very obviously under either of the above categories, I may here briefly quote two cases. A girl about twenty had been ailing for some twelve or fifteen months. She had been getting weak and thin, and had been suffering from attacks of severe sickness, coming on with some regularity every three or four days. The sickness was remarkable from the facts that during the three or four hours for which it lasted she would bring up as much as a couple of wash-hand-basinfuls of nearly clear fluid, that it was apparently independent of the ingestion of food, and that between whiles she had no symptoms of indigestion and had a good appetite. There was, further, no affection of the bowels, and no distinct abdominal enlargement or tenderness. These symptoms continued while she was under my care; but shortly after she came under my care, and then for the first time, a cough came on, consolidation was discovered under the left clavicle, and from that time pulmonary consumption made rapid progress. Her death, which was mainly caused by the pulmonary disease, occurred about three months after I first saw her; and at the post-mortem examination, there was found, in addition to extensive tubercular disease of the lungs, very extensive peritoneal tuberculosis. The stomach and bowels were healthy.—A young gentleman of two or three and twenty, who was at the time resident at Port Natal, became without any apparent cause subject to attacks of intense colic, in which he was compelled by the severity of the pain to throw himself down and writhe. He came over to England in consequence of the persistence of this affection. The attacks of pain still continued, coming on sometimes two or three times a day; but there was also some irregularity of the bowels. His illness lasted for a couple of years, and he died then from emaciation and exhaustion. There was more or less general tuberculosis discovered after death; but the chief deposit was in connection with the peritoneum. Occasionally the chief symptoms due to the presence of peritoneal tubercle are great obstinacy of the bowels, with gradually increasing emaciation and debility; and occasionally there is complete and insuperable obstruction. In some cases, ascites is the earliest prominent symptom, and it may continue the most prominent symptom, and then prove (as ascites from other causes often proves) the chief agent in causing death.

CARCINOMA OF THE PERITONEUM.

By John Syer Bristowe, M.D., F.R.C.P.

Pathology.—Carcinoma of the Peritoneum, using the term in its widest sense, is not infrequently met with. Taking for comparison the same period which furnished, from the medical wards of St. Thomas's Hospital, 349 cases of tuberculosis of which 49 presented peritoneal complications, there were 99 cases of cancer, in 22 of which the peritoneal membrane was affected. From these figures it would appear that while cancer of the peritoneum is less than half as common as tuberculosis of that membrane, it is considerably more common in reference to all cases of cancer than tubercle of the peritoneum is to all cases of tuberculosis.

There is probably no great difference in the liability of the two sexes to this disease; but there is no doubt, I think, that it is relatively less frequent in early life than tuberculosis. Of the 22 cases alluded to above, none occurred under twenty, 3 occurred between twenty and thirty, 4 between thirty and forty, 5 between forty and fifty, 5 between fifty and sixty, and 5 between sixty and seventy. In 2 cases the disease was apparently limited to the peritoneum, or had at most invaded the surface of organs invested with the peritoneum. It was associated in 11 cases with cancer of the stomach, in 10 with cancer of the liver, in 9 with cancer of the pleuræ, in 7 with cancer of the lungs, in 6 with cancer of the mesenteric glands, and in 3 severally with cancer of the bowels, kidneys, and ovaries. More than half the cases, however, of cancer of the bowels were combined with peritoneal cancer; rather less than half the cases of cancer of the pleuræ and stomach respectively were associated with it; and about a fourth of all cases of cancer of the liver, mesenteric glands, kidneys, ovaries, and lungs respectively presented the same complication. In 7 cases the peritoneal cancer was the predominant disease, in 10 cancer of the stomach, in 1 cancer of the liver, and in 1 cancer of the mesenteric glands. It may be added here, that in speaking of peritoneal cancer, those cases have been excluded in which that portion of peritoneum covering a cancerous organ has alone presented indications of cancerous growth.

Carcinoma of the Peritoneum presents most of the varieties which carcinoma presents in other parts of the body; namely, scirrhus, encephaloid (with its sub-variety melanotic cancer), and colloid. Scirrhus always commences in the form of flat, round, lenticular, hard, white spots, measuring perhaps on the average a line in diameter, which occupy the substance of the serous membrane, and though distinctly projecting from the surface, yet rather tend to invade and involve the sub-serous tissue. These are in the first instance scattered thinly or irregularly, but soon become aggregated in parts or generally, and then coalesce so as to form patches of various extent. The patches thus formed may be perfectly smooth on the surface, or may still present there traces of the mode in which they were originally formed; they rarely, however, form outgrowths, and pretty rarely invade subjacent organs; rarely, too, over the general peritoneal surface do they become more than a line or two thick, except when they involve duplicatures or processes of peritoneum. The latter involvement is indeed somewhat characteristic of the disease. The appendices epiplöicæ become converted into small hard masses, in which the cancerous deposit and the fat and other normal tissues become intermixed; the mesenteric and other like duplicatures become often similarly affected; and the great omentum, from the same cause, becomes contracted into a thick band, stretching transversely across the abdomen in the course of the transverse colon. Scirrhous cancer, in fact, as has long been recognized, tends rather to cause contraction of parts than outgrowths: and for this same reason has a special tendency not only to cause the contractions of loose tissues already adverted to, but to lead to obstruction of tubular organs, especially of the stomach, intestines, and larger bile-ducts. Encephaloid also in its early stage affects the substance of the peritoneum, and forms discrete nodular outgrowths, which are small and rounded, and differ from those of scirrhus not only in their greater softness, but also in their greater prominence. These are often indeed hemispherical, or even spherical or pyriform and pedunculated. In its further progress encephaloid presents great varieties. In some cases it seems, like scirrhus, to invade more particularly the substance of the peritoneal folds, and to

involve also subjacent organs; and under such circumstances we find sometimes the mesentery converted into a thick, plicated, cancerous mass, with the cancerous growth extending from the mesenteric attachment over the surface of the intestines; or we find the greater or lesser omentum or the sub-peritoneal tissue of other regions affected in like manner, and forming a more or less distinct tumor. In other cases it tends rather to form outgrowths which are sometimes small and clustered, sometimes more or less distinct from one another and rounded and massive. In the former instance the whole peritoneal surface may be found beset with small lobulated or bunch-of-currant-like excrescences, and the great omentum may be converted into a huge loose mass of such bodies. In the latter instance the tumors, though more or less abundant, are isolated, and while many probably are small, others form rounded solid masses which may attain the size of a child's head. So far as I know, melanotic cancer always manifests itself in this latter condition. Colloid disease in its early stage appears for the most part in the form of groups of vesicles which vary in fineness and have a close *primâ facie* resemblance to patches of eczema or herpes, or (if the fibroid element be abundant) in the form of slightly granular or delicately reticulated patches. Later on, the vesicle-like bodies are often as large as a millet-seed or tare. The patches often become more or less elevated above the level of the surrounding surface, and spread sometimes in tortuous and anastomosing lines as though taking the course of the lymphatic vessels, sometimes by forming scattered, isolated, somewhat pedunculated growths. This disease, like scirrhus and encephaloid, tends in various degrees both to involve subjacent organs and to diffuse itself over the peritoneal surface. It always involves the sub-peritoneal tissue, which may attain in consequence very considerable thickness; and it extends thence most frequently to the muscular and mucous coats of the stomach and intestines, less frequently to the substance of the mesenteric glands, pancreas, liver, spleen, or other viscera. In the most extreme cases of the disease, nearly the whole of the peritoneum is affected; this membrane is then irregularly thickened, with lumpy excrescences here and there; the various duplicatures become especially hypertrophied; and the great omentum is sometimes converted into a huge lobulated mass, or is contracted, as it generally is in scirrhus, into a thick irregular transverse band. In all these cases the adventitious growth retains its original more or less distinctly vesicular if not gelatinous character; and generally, sooner or later, from erosion of its surface, the glairy fluid contained in its substance is discharged in some abundance into the cavity of the abdomen.

Other varieties of cancer, such for example as osteoid cancer, are probably always secondary, and are of such extremely rare occurrence as to be of no practical importance.

All forms of abdominal cancer are liable in a greater or less degree to various complications. Among which may be enumerated: peritoneal inflammation, with the effusion of lymph or pus, or the escape of blood; ascites; obstructions of stomach or bowels; involvement of the viscera, such as the liver or kidneys, or their excretory ducts; and perforation of the stomach and intestines in other hollow organs.

Symptoms.—The symptoms of peritoneal cancer are necessarily very various and often quite as easy to be misunderstood as those of peritoneal tubercle. Febrile symptoms, varying in intensity and liable to remissions, gradually increasing debility and emaciation, more or less uneasiness or tenderness or pain in the abdomen, with hardness and enlargement of the same part, disturbance of the functions of the alimentary canal indicated by dry and glazed or coated tongue, thirst, loss of appetite, with perhaps nausea and sickness, and by constipation or diarrhœa or alternations of both, are symptoms which are common alike to cancer and to tubercle and to mere chronic inflammation of the peritoneum. It is important, however, to bear in mind that obstinate constipation is a very frequent accompaniment of this disease, and that much more frequently than in either tuberculosis or inflammation, death results from complete obstruction; also, that in a very large proportion of cases the stomach is involved in a greater or less degree, and that consequently the usual symptoms of stomach-cancer are very liable to be associated with those of the peritoneal affection; further, that in nearly half the cases there is cancer of the liver, not infrequently involving that organ through the gastro-hepatic omentum and Glisson's capsule, and that therefore obstruction of the bile-ducts and jaundice are of common occurrence; and lastly, that in the female there is frequent coexistence of ovarian and peritoneal cancer. The most important points, however, to which we must look for the formation of a correct diagnosis are, first, the presence of a growing tumor or tumors in the abdomen, and, second, the presence of similar disease in other parts. It need scarcely be said that cancerous tumors present all varieties of character; that they may occur in any region of the abdomen; that they may be movable or

fixed ; that they may vary widely in size and shape ; that they may be hard and resisting, or soft and almost yielding a sense of fluctuation ; and that, especially when they are developed in the neighborhood of the cœliac axis and superior mesenteric artery, they may pulsate as violently as many aneurisms do ; and that hence notwithstanding the important aid which their presence furnishes, they may be, and are not infrequently, confounded, at some stage at least of their progress, with circumscribed abscesses, or hydatid tumors, or floating kidneys, or even aneurisms. But in some cases where, although the cancerous disease is very extensive, the individual tumors are small, the presence of the peritoneal outgrowths may fail of detection, even when very careful examination has been made ; and necessarily this difficulty of detection is always greatly increased when ascitic fluid is present. It is worth while to draw attention to the fact, that not infrequently when no other signs of tumor are distinguishable, the presence of the thickened and contracted great omentum, which has been shown to be common in scirrhus and in colloid disease, may be recognized as a more or less irregular transverse bar extending horizontally from under the margins of the left ribs across the upper part of the umbilical region to the neighborhood of the umbilicus, and that this furnishes a valuable diagnostic sign.

It is impossible to lay down any rules with regard to the detection of concurrent cancerous disease in other organs ; but it is obvious that in all cases in which there is any ground to suspect that a patient may be suffering from internal cancer, a careful investigation of all superficial and other easily accessible parts should be made ; for not infrequently there may be found associated with the internal cancer, coming on before it, or appearing at a later period, cancerous nodules in the subcutaneous cellular tissue, cancerous growths of periosteum, or bone, or cancer affecting the uterus, mamma, or testis. Nor must it be forgotten that cancer of the pleuræ, lungs, and mediastinum, cancer of the brain, and cancer of the kidneys, are all with different degrees of frequency apt to be associated with cancer of the peritoneum.

Treatment of Abdominal Tubercle and Carcinoma.—There are stages in many varieties of the diseases coming under the above heads, when, as has been shown, they may be readily mistaken for other affections of a less grave character than themselves ; and when therefore it may be judicious to adopt the treatment, whatever it may be, which may seem most suitable for the more curable malady. But, assuming the fact of the presence of tubercle or of cancer to be known, the principles of treatment become exceedingly simple : they are, to relieve pain and discomfort by ministering to those symptoms which most distress the patient, and to support his strength by the judicious exhibition of food and stimulus, and by the use of medicines having a similar tendency. Abdominal pains may need to be relieved by the application of counter-irritants, or fomentations, or even leeches. Sleepless weariness and pain may require to be overcome by the use of opiates or other forms of sedative or narcotic medicines ; and indeed, in the progress of cancer especially, these remedies are often the only ones that can be employed, and may have to be given constantly and in large doses. Nausea, sickness, diarrhœa, obstruction of the bowels, will each in various cases call for treatment, but nothing special need be said in reference to them. That tonics, food, and stimulants, of such kind and in such quantities and at such intervals as the condition of the patient renders admissible should be persisted in is obvious, not only because the maintenance of life up to the extreme limits which the progress of the diseases admits of depends thereon—and it is our recognized duty as physicians to sustain life even when it is a hopeless burden—but because (to say nothing of the chance there may be of our diagnosis being in some cases erroneous) there may be, at least in the case of tubercular disease, a prospect, however remote, of ultimate recovery.

AFFECTIONS OF THE ABDOMINAL LYMPHATIC GLANDS.

By John Syer Bristowe, M.D., F.R.C.P.

The lymphatic and lacteal glands of the abdomen are frequently the seat of disease; sometimes they become inflamed, sometimes hypertrophied, sometimes tubercular, and sometimes the seat of the various forms of cancerous growth and of degenerative changes.

In inflammation they become enlarged, congested, softened, and tender, and sometimes undergo suppuration, and may then discharge their contents by various routes, and even by rupture into the peritoneum. When the inflammation subsides they may according to circumstances recover their healthy state, or remain enlarged, or become atrophied and indurated. The symptoms indicative of their inflammation are more or less pain and tenderness in the situation of the affected glands, with perhaps hardness or distinct tumor, and more or less violent inflammatory fever. Inflammation of the abdominal glands is probably of very common occurrence as secondary to inflammation or ulceration of the various organs with which they are in connection; but we are chiefly acquainted with inflammation of the mesenteric glands in enteric fever, and in dysentery, and of the lumbar glands and those about the brim of the pelvis in connection with inflammatory affections of the genito-urinary organs.

Hypertrophy of the glands is not very easy to separate from tubercular disease of the glands on the one hand, and from some forms of malignant disease on the other. It is indicated by a more or less gradual increase in their size, attended with a more or less fleshy consistence, and a color varying between a dull white or buff, and a reddish fleshy hue. It is an affection rarely limited to the glands of a particular part; and generally, therefore, when the abdominal glands are hypertrophied, the lymphatics of other parts of the body are hypertrophied also. The symptoms which attend this affection are rarely connected specially with the abdomen; excepting in so far as there may be a tumor there, and more or less impairment of nutrition; they are for the most part those of gradually increasing anæmia, and a form of cachexia, in which sometimes there is a remarkable increase of white corpuscles in the blood (Leucocythæmia).

Tubercular deposits, in the mesenteric glands especially, are not uncommonly associated with similar deposits in the peritoneum and intestines; and they generally form well-defined cheesy lumps embedded in enlarged and more or less congested gland substance. Not very infrequently such deposits take place in glands which have previously undergone hypertrophy, and to such an extent sometimes that whole glands become caseous. Tubercular glands sometimes soften or suppurate and form vomicæ; and very frequently indeed dry up and contract and become converted into inert cretaceous masses. This condition of glands is probably attended with no symptoms distinguishable from the symptoms due to the associated tubercular affection of other abdominal organs which is generally present.

Cancerous disease of the various abdominal glands is common in all its varieties. It is sometimes primary (in which case it is probably generally if not always some variety of what Virchow terms lymphoma). It is more frequently secondary to cancer of other parts; and then, for the most part, the glands chiefly affected are those which are in relation with the organ primarily affected. Thus, in cancer of the testis the lumbar glands become cancerous; in cancer affecting the remaining genito-urinary organs, and other organs situated in the pelvis, the glands which become specially implicated are those in the pelvis, and about its brim; in cancer of the bowels, the mesenteric glands chiefly suffer; and in cancer of the stomach, kidneys, and neighboring parts, the retro-peritoneal glands of the upper part of the abdomen. Cancerous glandular tumors sometimes attain an enormous size; and it is not infrequently by their growth and disintegration that perforation or obstruction of viscera, and other serious complications, which have been elsewhere sufficiently described, are produced. It is difficult, and would be useless, to discuss the symptoms and effects of such tumors apart from those of cancer of the peritoneum and other abdominal organs, which have been already fully considered.

In addition to the degenerations which

follow upon inflammation, and upon the deposition of tubercle, it may be stated that in extreme cases of lardaceous disease, the abdominal lacteal and lymphatic glands may share with other parts in this form of degeneration.

ASCITES.

By John Syer Bristowe, M.D., F.R.C.P.

Pathology. — The accumulation of fluid of a more or less serous character within the peritoneal cavity is called "Ascites," or "Abdominal Dropsy." It is an accompaniment or sequela of numerous different forms of disease; but depends immediately on some condition which modifies the action of the capillary vessels, and in some cases perhaps of the lymphatics, of the peritoneal membrane. This condition may be, in the first place, some morbid process going on in the peritoneal tissue, and affecting directly its minute vessels; or, in the second place, some impediment to the return of blood from them existing in the course of the portal system; or, in the last place, some impediment to the return of blood from them connected with some disease affecting generally the movement of blood in the systemic veins. Among the first of these classes may be included peritonitis, peritoneal tuberculosis, and peritoneal cancer; among the second, tumors or other growths obstructing the trunk or main branches of the vena portæ, chronic congestion and induration of the liver, lardaceous disease of that organ, and especially cirrhosis; and among the last, heart disease, Bright's disease, some affections of the lungs, and perhaps some forms of anæmia.

(1) Acute peritonitis, like acute inflammation of other serous membranes, is doubtless attended in most cases with more or less effusion of serum; but the effusion is rarely abundant and rarely amounts to what would be recognized during life as Ascites. Not very infrequently, however, when the acute peritonitic symptoms have subsided, and the patient appears to be convalescent or even well, abdominal dropsy slowly supervenes. Ascites is especially apt to occur in women in whom the peritoneal inflammation has been connected with some inflammatory condition of the pelvic organs. It is frequently associated with the growth of cystic ovarian tumors; and is then in some cases due either to the occasional rupture of small superficial cysts, or to the establishment of more extensive communications between the cavities of the ovary and that of the peritoneum, and the discharge of fluid from the thus exposed secreting surfaces into the abdominal cavity. In all these cases the peritonitis assumes a subacute or chronic character. Tubercular deposits in connection with the peritoneal surface are another fruitful cause of Ascites. In 12 out of the 48 cases of tubercular peritonitis analyzed on a former page, this condition was present, and several of them had been tapped. Abdominal cancer, again, is frequently attended with dropsical effusion. Of the 22 cases of peritoneal cancer previously considered, 11 had Ascites in a greater or less degree; and it may be added, that dropsy not infrequently attends cancerous disease of the ovaries and other pelvic organs, and of the mesenteric or retro-peritoneal glands. In what degree Ascites, dependent on disease of the peritoneal membrane, may be due severally or collectively to direct involvement of the capillaries and minute veins of that membrane, to obstruction of the lymphatic orifices which seem now proved to exist there, or to increased functional activity on the part of the epithelial cells, is not very easy, perhaps, to decide; but there is probably little doubt that, in some cases in which there is infiltration and contraction of the peritoneal folds, especially of the mesentery, the larger veins contained within them become, as Oppolzer suggests, obstructed, and that the Ascites is produced or augmented by this obstruction.

(2) Impediment to the passage of blood along the portal vessels, with consequent Ascites, may be caused by various morbid conditions; occasionally by the pressure on the vena portæ of an aneurismal, hydatid, or cancerous tumor, originating externally to the liver; more frequently by the pressure of cancerous, "knotty," syphilitic or hydatid tumors developed in the hepatic substance, and especially by cancerous and fibroid growths occupying the lesser omentum, and extending thence

into the liver along the capsule of Glisson; but most commonly by some general hepatic disease which involves the hepatic capillaries and the minute veins which open into and emerge from them. Of the diseases last referred to, cirrhosis is the most frequent and the most important. Cirrhosis, however, though doubtless tending in all cases ultimately to cause Ascites, is sometimes fatal by hæmatemesis before any dropsical effusion has taken place, and is not infrequently found to be present, unsuspected, in death from other visceral diseases. Out of forty-six cases in which cirrhosis was discovered *post mortem*, in twenty only was there more or less accumulation of ascitic fluid. The presence of a fibroid capsule, surrounding the liver, compressing it, and squeezing it into a comparatively small rounded mass, produces the same effect. This formation, which is probably of inflammatory origin, is sometimes associated with cirrhosis, or other morbid states of the liver, but is sometimes present when the liver seems otherwise perfectly healthy, and where it is the sole visible pathological phenomenon associated with Ascites. There is no doubt that lardaceous disease of the liver, also sometimes leads to abdominal effusion, and not improbably an extreme state of fatty deposition may have the same result; but in both of these cases the hepatic affection is almost always associated with still more serious disease in other organs, which is itself capable of causing dropsy, so that the influence of the liver in its causation is rendered somewhat difficult of identification. Similarly, it is quite certain that chronic induration and congestion of the liver, and especially that condition of the organ to which the name "nutmeg liver" is applied, are frequently instrumental in the production of Ascites, although they are themselves always secondary to dropsy-producing diseases, such as kidney disease, heart disease, chronic bronchitis and chronic phthisis.

(3) All the diseases which have just been enumerated, viz., chronic bronchitis and phthisis, heart diseases, and certain forms of kidney disease, which cause anasarca, cause naturally, as a part of that anasarca, effusion of serum into the abdominal cavity: but in most cases the abdominal effusion is proportional only to the effusion in other parts, and fails to be recognized as Ascites. In some cases, however, the dropsical accumulation in the abdomen becomes excessive, while that elsewhere undergoes but little increase. When this happens, it is usually in connection with, and then probably immediately dependent on, some abdominal complication of the primary disease, especially a congested or indurated, or nutmeg, or even a cirrhosed condition of the liver, or chronic inflammation of the general peritoneal surface, or of that of the liver. But sometimes even where the ascitic fluid has been so abundant as to need removal by operation, no trace of disease in any of the abdominal tissues or viscera can be discovered. There can be little doubt that in some forms of cachexia and anæmia, in which without there being any apparent visceral disease anasarca takes place, Ascites also occasionally ensues. Yet it may be remarked, that as cases of this kind usually get well, it must generally remain a matter of uncertainty as to whether or not there may have been some slight inflammatory affection of the peritoneum or some other evanescent local morbid condition on which the Ascites may have depended.

It may be added here, that in a very large proportion of cases of Ascites, several or even many organs are diseased at the same time so that it becomes difficult or impossible to determine upon what exactly the ascitic accumulation depends. Thus fibroid and lardaceous and other degenerations often affect simultaneously many organs, so that together with the liver we often find the kidneys, the spleen, the lungs, the heart, the bloodvessels, diseased in various degrees. Besides which, in all such cases there is a great tendency to inflammatory implication of the peritoneum as well as of other serous membranes; and tuberculosis is often present. This simultaneous affection of many different organs and tissues is specially common among those who have passed a life of debauchery, among those who have labored under the syphilitic cachexia, and among those who have suffered long from bone-disease, from protracted suppuration, or from chronic tuberculosis.

The amount of fluid present in Ascites may vary from a few pints up to four or five gallons, and indeed much larger quantities are recorded as having been met with. The fluid itself is for the most part slightly viscid, transparent, of a yellowish or greenish tinge, alkaline, and containing both albumen and fibrine (or fibrinogen). It may, however, under different circumstances, become very viscid, opaline, or opaque from inflammatory products, or it may contain blood.

It would be tedious and, it is feared, useless to go at any length into the statistics of Ascites; for in the first place Ascites is an incident only of many different forms of disease, the statistics of which, with those of their particular relations to abdominal dropsy, are all elsewhere sufficiently discussed; and, in the second place, to bring together the statistics of Ascites in the gross, would be to combine a number of heterogeneous figures

the manipulation of which could for the most part only lead to useless or fallacious results. There are a few facts, however, which the statistics of a general hospital have supplied me with, which it may be worth while to state. According to these statistics, there is little difference between males and females as regards their respective degrees of liability to Ascites, although undoubtedly hepatic dropsy is far more common in men than in women; Ascites is most frequent in the decades from thirty to forty and from forty to fifty, next in those from twenty to thirty and from fifty to sixty; but it is not uncommon, both above the latter age and in young children; it occurs with about equal frequency as the result of hepatic disease, heart disease, and kidney disease (in the latter two cases, however, generally combined with a congested or nutmeg or contracted condition of liver); it is from about one-half to one-third as common as a consequence of peritoneal cancer, peritoneal tubercle, bronchitis and phthisis severally; and, again, occurs in association with lardaceous disease of organs and ovarian cystic tumors respectively about half as frequently as in connection with each of the immediately foregoing diseases.

The prospect of the duration of Ascites, and of eventual recovery or death, necessarily depends almost entirely upon the nature of the disease on which the dropsy depends. Now, most of the diseases causing abdominal dropsy are from their nature lethal, and generally, therefore, Ascites must be regarded as a symptom terminable only with death. Yet even in some of these cases it is of very protracted duration, and relief may be afforded several times by tapping before the arrival of the fatal issue. But in some cases, and even when the disease causing it is usually a progressive disease, in chronic peritonitis, in cirrhosis, in the encapsuled state of the liver, and probably also in tubercular peritonitis, the dropsy may be sometimes arrested in its progress, or even, temporarily at least, recovered from. In some cases indeed, both in children and in adults, recovery from Ascites (the cause of which thus necessarily remains more or less obscure) is permanent.

Symptoms. — The symptoms due to Ascites alone are very simple and very characteristic of the affection. The accumulation of fluid within the abdominal cavity causes the abdomen to enlarge and become tense, and then sooner or later compresses and obstructs the intra-abdominal veins, especially those connected with the lower extremities, impedes the movements of the diaphragm, inducing difficulty of breathing, and interferes more or less injuriously with the healthy action of the abdominal viscera. It modifies also the patient's gait, making him walk like a pregnant woman, with his legs wide apart, and his head and shoulders thrown back.

The presence of fluid in the peritoneal cavity is generally easy of detection. The abdomen becomes large, uniformly rounded, but with a tendency to spread or bulge in the flanks as the patient lies on his back, tense and more or less smooth and shining, often presenting distended superficial veins and the linear lacerations of the deeper tissues of the skin which are so common in pregnancy. The stomach and intestines being lighter than the fluid, tend to float on its upper surface; and hence generally the highest part of the abdomen, according to the patient's position, is resonant, while the more dependent parts are dull, the line of demarcation between them being for the most part well-defined and horizontal: hence, too, as the patient changes his position, the fluid and the floating bowels, and necessarily therefore the areas of resonance and dulness, change their positions relatively to the abdominal parietes. It may be added that the liver, which is generally if not always of higher specific gravity than dropsical fluid, retreats sometimes distinctly, as the patient lies on his back, from the anterior surface of the abdomen, a stratum of fluid with sometimes a loop of floating bowel occupying the interval. The presence of fluid is further and very importantly indicated by the peculiar thrill which is experienced by the hand laid flat on the abdomen when a ripple or wave is produced in the ascitic fluid by a slight tap or fillip applied to some other part of the abdominal surface. These signs, however, are not always all present, or at least easy to recognize: and not infrequently tumors and other forms of disease simulate or mask abdominal dropsy. Thus when the ascitic fluid is in small quantity and occupies probably the pelvis only, the presence of dulness will scarcely be detected in any ordinary position which the patient may assume: it may generally, however, be certainly recognized if he be made to rest upon his elbows and knees so as to allow the fluid to gravitate to the neighborhood of the umbilicus. Thus, again, when peritoneal adhesions are present, both the evidence derivable from the relative positions of resonance and dulness, and the variability of these positions, and that also derivable from fluctuation, may wholly fail us. Thus too when the abdomen is enormously distended, the attachment of the stomach and intestines may be too short to allow of any of these parts reaching the surface of the abdomen and the dulness may be universal, a condition which does not indeed throw any difficulty in the way of

ascertaining the existence of fluid, but may make it not quite easy to determine whether the fluid is free in the abdominal cavity or whether it is contained in a large ovarian cyst. It need scarcely be said that, independently of the evidence afforded by the history of the case, by the form of the abdomen, and by vaginal examination, there is always in ovarian dropsy (unless indeed it be associated with Ascites) resonance in one or other or both flanks in consequence of the position which the tumor always takes in relation to the bowels; yet to insure accuracy it must not be forgotten that even in Ascites there may be a line of resonance in either flank due to the presence there of the colon. It must be added that œdema of the abdominal walls, or fat in them or in the mesentery, or the presence of diffused peritoneal cancer, are often serious impediments to the accurate diagnosis of moderate dropsical accumulations.

In most cases peritoneal dropsy causes merely that uniform distension of the abdomen which has been above described; but the distending force naturally exerts its most marked influence on those parts of the parietes which are weakest; and hence hernial sacs become often very greatly dilated and attenuated, especially perhaps the sacs of umbilical herniæ; hence, too, in some cases of Ascites in females the recto-vaginal pouch becomes greatly distended, and even protruded through the vulva in the form of a tumor, carrying with it as a covering the posterior wall of the vagina. I recollect one case in which the formation of such a tumor caused not only prolapse of the whole of the posterior wall of the vagina, but also of the upper part of the anterior wall together with the os uteri, which latter was found on the convexity of the tumor. The body of the uterus retained its normal position, but its neck had by the traction exerted on it by the gradual descent of the posterior wall of the vagina been attenuated and drawn out to a length of three or four inches. Occasionally Ascites has been relieved by the spontaneous rupture or perforation of some thinned portions of the abdominal parietes.

Œdema of the lower extremities and intervening parts is a very general and early accompaniment of abdominal dropsy. Sometimes it occurs at so early a period as to be the first symptom of disease which the patient himself recognizes, and indeed it is not very uncommon for ascitic patients to assert that their illness began with swelling of the legs. There is no doubt that in dropsy from abdominal disease this complication is due to the impediment to the return of blood produced by the pressure of the ascitic fluid on the iliac veins. It increases for the most part with the increase of the conditions on which it depends; and may become as excessive as that from cardiac or renal disease; but it rarely extends beyond the part with which the mechanically-impeded veins are immediately connected, and never becomes general. It need scarcely, however, be said, that when Ascites is connected with diseases of the heart, lungs, or kidneys, general anasarca is very often present. Anasarca due to abdominal dropsy is generally equal in the two lower limbs; and in this respect differs for the most part from anasarca in the legs resulting from abdominal tumors or from obstruction by clot of the iliac veins.

Shortness of breath is an early symptom, and it increases with the increase of the dropsy. It is not always noticed by the patient himself while he remains quiet in the sitting or semi-recumbent posture. But even at such times the physician will probably observe that the respiratory acts are unduly quick and shallow. Ultimately, however, this symptom becomes very painful and distressing. It is obviously caused by the encroachment of the enlarging abdomen upon the thoracic cavity, by which the diaphragm becomes pushed up and prevented from performing the movements necessary for perfect respiration. The lower portions of the lungs become consequently more or less empty of air and collapsed; and, as might be anticipated from a knowledge of its cause, it is also much aggravated when the patient lies down.

Although in the earlier stages there may be little or no abdominal discomfort, there generally arises in the course of the affection a good deal of aching, which is usually complained of most in the flanks and across the epigastric or umbilical regions. This is probably due to the pressure which the fluid exerts on the various tissues, but more particularly to that which it exerts on the hollow viscera. This pain is sometimes associated with that of distinct colic, and not very infrequently, when the abdomen has become very largely distended, with pain of a peritonitic character. Indeed, acute or subacute peritonitis is far from rare in the latter stages of Ascites. It may be added, that diarrhœa is not uncommon in the course of Ascites, and that it seems to be sometimes due to the same impediment to the portal circulation which causes the Ascites itself, and is sometimes dependent on some slight dysenteric inflammation; and that although early in the affection there may be no visible morbid condition of tongue and neither thirst nor loss of appetite, the tongue and the digestive functions after a while all become variously and more or less seriously affected. It may be added further, that

patients almost invariably complain of flatulency, a complaint which is undoubtedly due in many cases to excessive flatulent distension of the bowels, but may in some degree be explained by the discomfort which, in the presence of much ascitic fluid, even a normal amount of gaseous distension may occasion. There is generally some dryness of skin and some diminution in the urinary secretion.

There are many symptoms, more or less grave, besides those which have been considered, which may be presented by ascitic patients; but they are symptoms for the most part due to the diseases upon which the Ascites itself depends, and are sufficiently considered elsewhere under the heads of those diseases.

TREATMENT.—The treatment of Ascites, in a large proportion of cases, merges in the treatment of the disease by which it has been caused. Still, in some cases from the very beginning, and in most when the accumulation becomes very great, special treatment directed against the Ascites is, or appears to be, called for. To promote the absorption and removal of the ascitic fluid there are good theoretical reasons for the employment of those remedial measures which increase the discharges from the skin, the kidneys, and the bowels. The skin in cases of Ascites is usually unnaturally dry, and this fact seems to furnish an additional argument in favor of the use of diaphoretics. There is no doubt, indeed, that diaphoretic remedies are very generally beneficial to the patient. And amongst these must not be forgotten the most powerful of all, namely, the hot-bath, the vapor-bath, and the Turkish bath. Again, the frequent diminution in the urinary secretion may be urged as a further motive for the employment of diuretics; and again, it may be stated generally that the promotion of the flow of urine is serviceable. Still more, the close connection between the peritoneal membrane and the mucous lining of the bowels, and the fact that in hepatic obstructions the mesenteric capillaries sometimes relieve themselves by discharge of serum at the serous surface, sometimes by the escape of serum or blood at the mucous surface, would seem to be decisive as to the value of purgatives, and more especially of watery purgatives; and it may be freely admitted that purgatives are very often beneficial. I must confess, however, that although fully acquiescing in the importance of restoring as far as may be, and of maintaining, the healthy action of the skin and kidneys, and of promoting a tolerably free action of the bowels, I have never, to the best of my recollection and belief, seen an ascitic patient materially relieved as regards his Ascites, far less cured, by a course of either diaphoretics, diuretics, or purgatives. And in respect to purgatives, I may add that I have frequently had to discard them because, while they were not distinctly benefiting the dropsy, they were obviously affecting the patient's health injuriously; and further, that according to my own experience, diarrhœa is a not infrequent concomitant of Ascites, and is often difficult to arrest, and often of bad augury. There are, however, certain medicines which are more or less diuretic in their action which have been, or are, supposed to have, occasionally at least, a specific influence over dropsical accumulations in serous membranes, and under the use of which occasional recoveries are recorded. Among these may be enumerated mercury, iodide and bromide of potassium, copaiba, and the combination of fresh squills and crude mercury.

But it must be repeated that, as a rule, the treatment which is directed towards the alleviation or cure of the disease or condition of health to which the Ascites is secondary, is that which is most likely to be curative as regards the dropsy. The modes of treating heart diseases, kidney diseases, bronchitis, cirrhosis, and so on, need not be here discussed; but it may be pointed out that in a considerable number of cases of Ascites, and even in many of those in which the Ascites is dependent on the diseases which have just been enumerated, there is present a greater or less degree of anæmia and want of tone, and that in some at least of these cases anæmia and want of tone are in some degree instrumental in producing the dropsy. It is certain that tonics are very often well borne by ascitic patients, and that even when not well borne at first a little judiciousness in their employment, or in the employment of other preparatory measures, will render them tolerable; and it is certain that under their use ascitic patients do often not only improve in health, but lose, in part or wholly, their dropsical accumulation, and that occasionally the recovery is permanent, and permanent even after the performance of paracentesis. Quinine, iron, and cod-liver oil are probably the most valuable forms of tonics.

Counter-irritants and other forms of local applications are doubtless sometimes useful for the relief of uneasiness and pain; but no such applications are of use in promoting absorption of the fluid. But when the abdomen has become very much distended, and the patient is suffering seriously from the inconvenience and distress which attend such distension, the removal of the dropsical fluid by paracentesis becomes necessary. The time for the performance of this operation must be determined for each case, less by the actual distension of the belly than by the

gravity of the symptoms which attend that distension. The operation is generally postponed as long as possible, and I believe rightly; but it may be worth while to state that it has not very infrequently appeared to me that the beneficial effects of remedies have been exerted in a much greater degree after paracentesis than while the belly was largely distended. Paracentesis is generally a harmless operation; but sometimes peritonitis ensues, and is apt to be rapidly fatal. I believe that in cases of peritoneal dropsy dependent on cancerous disease of the abdomen tapping is not only very rarely of even temporary benefit, but that it generally hastens death. Iodine and other substances have occasionally been injected into the peritoneum for the cure of Ascites, and successful cases of this hazardous kind of treatment are recorded.

[Dr. Reginald Southey has reported[1] success with a modification of the process of tapping, which deserves more extended trial. It is, the insertion, after puncturing the abdomen with a needle trochar, of a fine canula, for gradual drainage. He prefers, for the point of puncture, the mesial line, half way between the umbilicus and the pubes; the bladder being always emptied before the operation. From ten to twenty ounces of fluid passing away through the canula per hour, the abdominal walls and viscera gradually adjust themselves to the diminution of pressure, without danger of syncope or need of bandaging the abdomen. The same method of drainage has been repeatedly used by Dr. Southey for the relief of anasarca.—H.]

[1] Lancet, August 10, 1878.]

F. DISEASES OF THE LIVER.

1. HEPATALGIA.
2. CONGESTION OF THE LIVER.
3. JAUNDICE.
4. BILIARY CALCULI.
5. SUPPURATIVE INFLAMMATION OF THE LIVER; HEPATITIS.
6. CHRONIC ATROPHY OF THE LIVER; CIRRHOSIS.
7. ACUTE ATROPHY OF THE LIVER; YELLOW ATROPHY.
8. FATTY LIVER.
9. CARCINOMA.
10. HYDATIDS OF LIVER.
11. WAXY LIVER.

HEPATALGIA.

BY FRANCIS EDMUND AINSTIE, M.D.

DEFINITION.—An affection characterized by attacks of deeply seated pain in the region of the liver; intermittent, in the manner of neuralgias; attended by no organic changes or febrile disturbance; not necessarily involving any interference with secretion; but occasionally attended with arrest or perversion of the biliary secretion and consequent jaundice and stomach-derangement.

CLINICAL HISTORY.—It must be confessed that there are many difficulties in drawing a clear and recognizable picture of this disease, of the separate existence of which I am, however, convinced. Some of these difficulties will be more fully pointed out under the head of "Diagnosis;" but it will at once be evident that the deep situation of the liver within the body must render it far from easy to localize so impalpable a thing as pain with certainty in the hepatic nerves. Valleix, indeed, does not hesitate to throw serious doubt on the identification of Hepatalgia as a substantive affection, and his great authority has probably induced many to discredit its existence as a separate disease. Nevertheless, the following picture, drawn from my experience of cases which have been under my own notice, will probably be thought to represent a sufficiently distinctive malady.

The subjects of Hepatalgia are probably never troubled *only* by pain in the liver; they are persons of a nervous temperament, in whom a slight shock to, or fatigue of, the nervous system habitually provokes neuralgic attacks; the pain localizing itself sometimes in the branches of the trigeminal, sometimes in those of the sciatic, sometimes in the intercostal nerves, etc. In one instance which has been under my observation, the attacks of Hepatalgia alternated with cardiac neuralgia, assuming the type of a rather severe angina pectoris. In another case the patient, a man aged sixty-seven, was very liable to attacks of intermittent abdominal agony, in which one could hardly doubt that the pain was located in the colon, and was attended with paralytic distension of the bowel; the peculiar feature of the case being the sudden way in which the symptoms would appear and depart, independently of any recognizable provocation or the use of any remedies. On two separate occasions this patient was attacked with pain of a precisely similar kind, but limited to the right hypochondrium, attended with great depression of spirits, and followed by a well-pronounced jaundice. So remarkable was the conjunction of symptoms in these two attacks that a strong suspicion of biliary calculus was raised, but not the slightest confirmation of this idea could be obtained; and indeed one symptom—vomiting—which nearly always attends the *painful* passage of a biliary calculus, was altogether absent.

Putting aside a considerable number of

cases in which "pain in the liver" was vaguely complained of by patients who were plainly hypochondriacal, and whose account of their own sufferings could not be relied on, I have altogether seen five instances of what I regard as genuine Hepatalgia. The first of these was very remarkable in its history and in all its features. The patient was a respectable girl of eighteen, subject to migraine, who had reason to fear that she had become pregnant, though this proved, ultimately, not to be the case. Under these circumstances she was attacked with intermittent pains, in the right hypochondrium, of intolerable severity; resembling, in fact, the pain of biliary calculus, but without the sense of abdominal constriction, and without any vomiting. These recurred daily at about the same hour in the morning, for about ten days; when, rather suddenly, a jaundiced tint appeared upon the face, and very shortly the whole skin was colored bright yellow; there was intense mental apathy; the urine was loaded with bile pigment, and the feces clay-colored. This state of things lasted only about a week, and then very rapidly disappeared; but as the jaundice subsided there was a partial recurrence of the neuralgic pains, which, for a day or two, were as severe as they had ever been. The other four cases of Hepatalgia which I have seen, including that of the man above mentioned, have all been in persons in advanced life; but, except the latter, neither of them displayed any symptoms of disordered biliary secretion; and the diagnosis (as to *situation*, for the *character* of the attacks was manifestly neuralgic) rested mainly on the fact that the pain radiated to the shoulder.

There remains to be noticed one clinical feature of the disease, which, I believe, is characteristic; namely, the peculiar mental depression which attended all the cases I have seen, but was most marked in the two in which jaundice occurred. In the girl above referred to, the apathy, during the period when there was jaundice but no pain, was even alarming, it reminded one of the mental state in commencing catalepsy; during the painful stages it was more like the gloom of suicidal melancholia. Of course, the acute mental anxiety which this patient had suffered would account for a good deal of this; but the symptom was as distinct, though less severe, in the case of an elderly lady, whom I have attended on another occasion for migraine; here there was no recognizable source of anxiety; and, on the other hand, there was no reason to suspect the retention of bile-elements in the blood. It seems, therefore, as if an essentially depressing influence on the mind was excited by hepatic neuralgia; or else, that emotional causes are the chief source of the malady.

Pathology and Etiology.— Of the true pathological conditions of Hepatalgia we know even less than of those which prevail in other neuralgias: the one antecedent fact recognizable is the existence of nervous depression. It is probable that pure neuralgic pain never attacks organs so slenderly provided with sensory nerves as the liver, except in subjects who belong to families of a markedly neurotic type, and that this hereditary constitution is the main predisposing cause. Of exciting causes, the most probable are mental shock or continued anxiety of mind: one may also suppose it probable that the gouty taint might excite Hepatalgia, as it undoubtedly can excite gastralgia; but I have seen no such case.

Diagnosis.—(*a*) The first difficulty in identifying a case of Hepatalgia is the exclusion of painful affections of the abdominal walls. Myalgic affections of the abdominal muscles are very common, but the distinction of these from Hepatalgia may be established with certainty; there will always be a history of undue and persistent strain upon the muscles, from the nature of the patient's occupation, or else from some unusual exertion which he has made; and the pain itself will be diffused, never completely intermitting, and strikingly aggravated by movements. (*b*) Abdominal neuralgia, *i. e.*, neuralgia of the abdominal branches of the dorsal and lumbar nerves, is more difficult to distinguish from Hepatalgia; and cases might easily arise in which it would be impossible to say whether the pain was parietal or visceral; unless, indeed, we are warranted in supposing that the mental depression already mentioned as attendant on all the cases of Hepatalgia which I have seen is a truly characteristic and necessary attendant of the latter affection. The absence of "*points douloureux*" would tend to exclude the theory of parietal neuralgia. (*c*) The violent pain which attends the difficult passage of a biliary calculus towards the bowel strongly resembles neuralgia in some cases, though it is usually too continuous and unremitting to be long mistaken for it; but the great points of distinction are the absence, in Hepatalgia, of the sense of constriction and the vomiting, which almost universally mark the passage of a calculus. (*d*) The existence of malignant disease in the liver or the neighboring organs might give rise to paroxysms of lancinating pain wholly undistinguishable in themselves from neuralgia; and in the early stages, before the constitutional signs of the diathesis were well marked, it might be impossible to make an accurate diagnosis. (*e*) Abdominal tumors of any kind, but more especially aneurism of the aorta or of the cœliac axis, have been known to

cause agonizing pain of an intermittent type, apparently referable to the region of the liver; and in this case nothing but the progress of the disease, and the ultimate development of the physical signs, could establish the diagnosis. (*f*) Accumulation of feces in the ascending and transverse colon has sometimes given rise to pain closely resembling neuralgia, and referred to a point deep in the right hypochondrium: here the existence of obstinate (though not necessarily complete) constipation will assist our judgment; and, besides, this kind of pain is usually felt in the right flank and in the back, as severely as in front. (*g*) Last, and most difficult of all pains to be distinguished from genuine Hepatalgia, is the severe pain in the right side so often experienced by hypochondriacal patients. Nothing can avail us here but a thorough and comprehensive review of the whole clinical history of the case, and of the antecedents and family history of the patient; and for this purpose we must refer the reader to the description of the symptoms of hypochondriasis, and of the hypochondriacal constitution generally, which are to be found elsewhere in this System of Medicine.

Prognosis. — There is no reason to think that Hepatalgia ever assumes the type of the inveterate and incurable neuralgias, although the suffering may be extremely severe while it lasts. It seems rather to be an occasional and transitory affection, occurring in patients liable to neuralgic affections of other parts. The persistence of pain, otherwise corresponding to the type of Hepatalgia, for any great length of time, should always lead us to suspect that there is, in reality, some permanent organic cause of pressure upon the nerves.

Treatment.—I am unable to speak from personal experience of the treatment of Hepatalgia arising from malarious poisoning, if such an affection exists, as is probable enough. We can hardly doubt that quinine would be the appropriate and most efficacious remedy in such cases. But in regard to Hepatalgia, as recognized by me in the five cases already referred to, I can state, decidedly, that quinine afforded no relief, while in all of them another remedy *did* effect striking good. The first case that came under my notice was that of the girl who, as already stated, was suffering from severe mental anxiety in consequence of imagining herself to be pregnant; here the tentative use of sal-volatile gave some relief, and the *muriate* of ammonia was then administered in half-drachm doses every four hours. Nothing could be more striking than the amendment in this case. The drug was administered during the stage of jaundice, and that symptom immediately began to disappear with great rapidity; the neuralgic pains reappeared, but only for a day or two, and in a comparatively mild form; they ceased altogether after a day or two. In every subsequent case of Hepatalgia my experience was the same; quinine afforded no relief, muriate of ammonia quickly produced improvement, and in a very few days the pain altogether disappeared.

CONGESTION OF THE LIVER.

By W. C. Maclean, M.D.

Definition.—Hyperæmia of the gland, characterized by equable enlargement in every direction; a dusky and sometimes jaundiced complexion, with a sense of uneasiness in the right side, not amounting to pain; weight and fulness in the right hypochondrium, apt, if long continued, to be followed by atrophy of the hepatic parenchyma, and by cirrhosis, in men of intemperate habits. Caused by (*a*) obstruction to the circulation in the chest, (*b*) by malarial fevers, (*c*) by the use of too rich food and the abuse of fermented and spirituous liquors, (*d*) by chills following exertion.

Pathology.—Whatever interferes with the circulation in the chest indirectly tends to produce hyperæmia of the liver. Valvular disease of the heart, such as incompetency of the mitral valve, causes stagnation of blood in the vena cava and hepatic veins; in time "this is propagated to the portal vein, and to the organs in which this vessel takes its origin" (Frerichs). The liver becomes turgid with blood, and congestion extends to the venous system of all the digestive organs; the skin, at first dusky from imperfect aëration of the blood, becomes finally jaundiced from impeded elimina-

tion of bile. The result of this capillary congestion, if long continued, is diminution in the size of the organ "from atrophy of the hepatic cells" (Budd, Frerichs).

Congestion of the Liver, the result of malarial fevers, has already been described (article Malarial Fevers, Vol. I.). Dr. Graves regarded the hyperæmia of the liver so often observed in intermittents, as a form of hepatitis. Whatever may have been the case within the sphere of this eminent physician's observation, inflammation of the liver, in the course of a malarial fever, is an extremely rare occurrence in India. Out of 243 cases of intermittent fever, Morehead observed inflammation of the liver in six cases only. In remittent fever true hepatitis is equally rare, but Congestion of the Liver is more frequent than in intermittents.

That Congestion of the Liver often follows the undue consumption of stimulating food, and the abuse of fermented liquors and ardent spirits, is generally allowed. I have seldom known a great beer drinker in India, who was not subject to attacks of Congestion of the Liver, unless he happened to be a man of very active habits with vigorous respiration. Spirit drinkers eventually suffer from adhesive inflammation of the connective tissue of the gland, with all its grave consequences, but it is not the less true that in the early days of this baneful habit they are liable to hyperæmia of the gland.

Morehead denies that Congestion of the Liver follows the direct transmission of noxious matters of food by the portal blood from the intestine to the liver, on the ground that the assimilable portion of the food is absorbed in the upper parts of the canal, and that the fluid part of the residual matters, which is absorbed from the large intestine, consists solely of the innocuous parts of the mass.

If it be true that nature possesses a power of selection to such an extent as this opinion implies, habitual diners-out and lovers of the "good things" of the table ought to suffer less than, I suspect, is common in their experience. I need scarcely add that, although Morehead gives our assimilative organs more credit for judicious selection than I fear they deserve, he only calls in question Dr. Budd's mode of explaining hyperæmia of the liver from over-indulgence at table, for he freely admits that excess in eating and drinking deranges the functions of the liver in common with those of the digestive organs.

Congestion of the gland often follows chills after violent exercise. Some of the most marked cases of the affection seen by me in hot climates have followed chills after severe exertion in the racket-court, more particularly when the game has been played too soon after eating.

Symptoms.—Whatever be the cause, enlargement of the organ in all directions is a constant symptom of hyperæmia of the liver. The gland will be found to extend from an inch to an inch and a half below the level of the ribs, and as much beyond its normal limits in the mammary region. The patient complains of a sense of fulness and weight in the right side, and a change of position from the right to the left side aggravates his uneasy sensations. In that sad class of cases depending on organic disease of the heart, the symptoms, general and local, characteristic of the heart affection, will be present in proportion to the extent and duration of the organic disease, viz., dyspnœa, dinginess and jaundice of the countenance, dropsical effusion, and the abnormal heart-sounds characteristic of the valvular lesion. Frerichs has noticed that the urine is scanty, dark-colored, and albuminous in cases depending on obstructed circulation, and in several men dying at Netley from the consequences of disease of the mitral orifice, with enlargement of the liver and great derangement of all the digestive organs, the same dark, scanty, and albuminous condition of the urine was noticed.

Morbid Anatomy.—A congested liver is enlarged in all directions. The capsule is smooth and stretched. The gland bleeds freely on section. In cases of longer standing, less blood follows the knife, but what has been called a nutmeg-like appearance is seen (Bright, Frerichs). Sometimes, as is recorded in the note of the post-mortem examination of one of the patients referred to above, the parenchyma has a uniform dark-red hue, "with branching dark streaks marking the positions of the hepatic veins." The other abdominal viscera are usually congested with serous blood.

Diagnosis.—In cases depending on obstruction to the circulation from heart-disease, there need be no difficulty in the diagnosis. When cardiac symptoms are sufficiently developed to cause any appreciable Congestion of the Liver they declare themselves by their characteristic signs, which can hardly escape the notice of an attentive physician.

The diagnosis, between mere Congestion of the Liver and commencing hepatitis, is important in hot climates. Enlargement of the liver, with fulness, weight, and uneasiness not amounting to pain, if they occur in a part of the world where suppurative inflammation of the gland is common will always cause anxiety. If the above symptoms are present in the course of a malarial fever, they need not be regarded with alarm, for while Congestion of the Liver in such diseases is

common, inflammatory action leading to suppuration is extremely rare. In passive congestion the patient is tolerant of free palpation and percussion, there is no sympathetic pain in the shoulder, no fever, no increased frequency of the pulse. When pain and enlargement coincide, the case is more serious. A careful physician, bearing in mind the extreme importance of the diagnosis in doubtful cases, will not fail to examine them with the greatest care.

Prognosis.—In congestion depending on mere errors in diet, or occurring in the course of a malarial fever, the prognosis is of course favorable. When hyperæmia of the gland is the result of organic disease of the heart, the unfavorable prognosis is governed almost entirely by considerations connected with that disease.

Treatment.—Congestion of the Liver, the result of indulgence at table, is easily remedied, provided the patient co-operates with the physician. The action of a few mild saline purges, abstinence at first, and a more guarded regimen for the future, usually suffice; the surface may be stimulated by a turpentine stupe, and if the kidneys are not acting well, saline diuretics should be given. Beer-drinkers suffering in this way should be advised to substitute the light wines of France for their favorite beverage, and to dilute them as the French do. Spirit-drinkers should be warned of the inevitable consequences of their habits. Not many months ago, a gentleman was landed at Southampton from Ceylon, dropsical from cirrhosed liver; my friends Mr. King Sampson and Dr. Trend will remember the case well. This gentleman told me his sad history: "Five years ago I consulted Dr. Budd for Congestion of the Liver, who advised me to change my way of living, and warned me if I did not I should die dropsical. I returned to Ceylon and to my old habits, and here I am."—The treatment in cases depending on heart-disease must be palliative, and should be carefully conducted. Where circumstances admit of it, and the case is not too far advanced, the patient may be advised to visit a suitable watering-place. Patients will often do this, who cannot be persuaded to take what is recommended in the shape of physic. Frerichs recommends the Ragoczy spring of Kissengen, or the Mill springs of Karlsbad, or the waters of Marienbad. A few leeches to the anus often give much relief, but cannot be often repeated: it is a common remedy in Indian hospitals. Attention must be paid to the bowels and kidneys, which should be kept active by a judicious selection of aperients and diuretics. As a congested state of the liver adds greatly to the patient's distress, no pains should be spared to lessen it by such means as are indicated above, and the patient's diet should be of as unstimulating a quality as possible.

When permanent enlargement of liver or spleen, with or without induration, follows the congestion incident to repeated attacks of malarial fevers, or long residence in malarial places without such attacks, immediate change of climate is necessary. In cases of this kind benefit often follows the prolonged use of a combination of iron and quinine, such, for example, as Dr. Easton's syrup of the phosphates of iron, quinia, and strychnia, a formula for which will be found in the first volume of this work. Great comfort and support is given by the use of what is called the hydropathic belt, which keeps up steady pressure on the distended parts.[1] The more obstinate cases rarely resist the application of the ointment of the biniodide of mercury, used in the manner described by me in the article on Intermittent Fever, in the first volume of this work, and in the Medical and Statistical Reports of the Army.

A more extended use of this ointment at Netley, in this class of cases, has shown this to be a remedy of real efficacy.

[1] These belts are made of stout calico shaped to the abdomen with cross pieces of tape on the inner side, which keep next to the skin a fold of cloth wrung out of cold water, and a piece of waterproof cloth or oiled silk to prevent evaporation.

JAUNDICE.

By Edward Goodeve, M.B.

Definition.—Jaundice, or Icterus, is a condition attending many diseases involving the liver or biliary passages, known by yellowness of the tissues and of many secretions of the body, and associated with symptoms of various degrees of severity affecting the vascular and nervous systems and the functions of digestion and nutrition. It is in reality a secondary affection, the causes of which are numerous and of widely different character, but from its importance it is generally considered worthy of separate notice in works of medicine.

Etiology.—In Jaundice the discharge of bile into the duodenum through the common duct is wholly or partially prevented, or, according to general but by no means universal opinion, the secretion itself is suppressed. The bile may be mechanically retained in the biliary passages or receptacles, and being absorbed therefrom become diffused through and color the tissues; on the other hand, there may be no such mechanical impediment and Jaundice may nevertheless exist.

Jaundice may be produced artificially in animals by ligature of the common duct, so that it can be proved experimentally that complete obstruction of the flow of bile into the intestine is adequate to cause the disease. The mechanism of Jaundice from obstruction is easily understood, but, as before said, Jaundice occurs also in cases in which no obstruction can be discovered, as when it follows mental emotion, certain cases of blood-poisoning, many fevers, pyæmia, poisoning by phosphorous, snake-bites, &c. These cases are much more difficult of explanation, and their causation has given rise to many theories and to great differences of opinion.

The following are among the principal views that have been held as to the cause of the non-mechanical forms of Jaundice:—

1. That the bile, not being eliminated or excreted by the liver, accumulates in the blood and dyes the tissues yellow. This attributes the Jaundice to suppression of secretion.

2. That in some diseases the hæmatin of the blood is changed into bile-pigment with disintegration of a large number of blood-corpuscles, assigning a blood-origin to the coloring matter of Jaundice.

3. The opinion of Professor Frerichs, who attributes non-obstructive Jaundice either to abnormal diffusion of bile, arising from some alteration in the circulation of the blood in the liver, or else to defective metamorphosis, or impaired consumption of bile in the blood. His views are stated in the two following propositions:—

1. Increased absorption of bile from the liver into the blood.

2. Through small consumption or sparing change of the bile which has been taken up into the blood.[1]

These three views demand a brief consideration:—

The first or suppression theory supposes that bile exists pre-formed in the blood, and that it is merely filtered off by the liver, not formed in it; and that owing to some derangement, structural or functional, of that organ, it accumulates in the blood as urea does in certain diseases of the kidney, or when they are extirpated in animals.

Bile is a compound fluid containing coloring matter, cholepyrrhin or biliverdine, and two acids, glycocholic and taurocholic, the acids combined with soda-bases. It is possible that some of the constituents of this compound liquid may be formed in the liver, and that others are merely separated by it from the blood. Most physiologists admit that the bile-acids are formed in the organ, but there is more difference of opinion about the pigment, and it is in the behavior of this constituent in Jaundice that the chief interest centres. It is supposed by some to exist in minute quantities in the blood, and many writers believe that it is merely separated therefrom by the liver. This view of suppression of secretion of the coloring matter in Jaundice is supported by Dr. Budd[2] and by Dr. Harley,[3] who admit that the biliary acids do not pre-exist in the blood. The most serious objection to the opinion lies in the fact that the

[1] Frerichs, Clinical Treatise on Diseases of the Liver, Sydenham Society's Translation, vol. i. p. 85.

[2] Diseases of the Liver, second edition, p. 458.

[3] Harley on Jaundice, p. 22.

coloring matter does not accumulate in their blood when the liver in animals is extirpated.

The second view is founded on the supposed intimate relations between hæmatin and bile-pigment. Hæmatin has not actually been converted into bile-pigment in the laboratory, but the changes in the blood extravasated in contusions, and the yellow sputum in some cases of pneumonia without Jaundice, the yellowness of newly-born infants, show the probability of a connection between them. It has been argued by Breschet, Virchow,[1] and others, that in some diseases the transformation takes place in the bloodvessels, and that thus a supply of yellow pigment is created independently of the action of the liver, constituting a Jaundice of blood-origin. Virchow has lately modified his views as to the frequency of the occurrence of Jaundice of blood-origin, believing that many of the cases which he formerly held to be due to blood-changes are caused by a catarrhal state of the passages.[2]

The third view, that of Frerichs, contains, as already stated, two propositions. In the first, that, owing to deranged hepatic circulation, the bile may be supposed to tend towards the veins instead of towards the bile-ducts; that, for instance, this would be facilitated by circumstances which would diminish tension in the portal vein. In the second case, that the biliary acids, which are normally absorbed into the blood and there undergo changes, probably of oxidation, which end in the production of urinary pigment, have their progress interfered with in fevers and the other abnormal states already mentioned; the metamorphosis ending in the stage of bile-pigment which circulates with the blood and is diffused through and colors the tissues. According to the first proposition, the liver would play an important part, but less so in the second.

It is impossible in this place to give a detailed account of Frerichs' reasons for these views. They will be found in the New Sydenham Society's translation of his work. Neither will space permit any detailed examination of the other opinions.

Frerichs' views have given rise to much discussion and differences as to matters of fact. Thus, Frerichs denies that the bile-acids appear in the urine in any case of Jaundice; they should do this if they circulated unchanged in the blood; and in this he is supported by Stadeler, Neukom, and others. On the other hand, Kühne, Harley, and others assert that they are to be found in the urine in cases of obstructive Jaundice. Frerichs denies also that the bile-acids are to be found in the blood at any time. Kühne's experiments tend to show that they can be detected in the blood in about twenty-four hours after ligature of the common duct in the dog.[1] Dr. Harley believes he can reconcile these opposite statements as regards the urine. He thinks that the discrepancy depends upon the nature of the cases observed, and asserts unhesitatingly that in Jaundice with obstruction the bile-acids will be found in the urine as long as the secreting tissue of the liver continues to act efficiently, but that in cases without obstruction, with complete suppression, they are not to be found.[2] This is consistent with the theory of bile being composed of a filtrate and a secretion. He points out that, even in cases of obstructive Jaundice, the bile-acids may be absent from the urine in the later stages, because in the progress of the disease the secreting tissue is destroyed, and thus that suppression naturally succeeds permanent obstruction. Dr. Harley considers that, the majority of cases of Jaundice being non-obstructive, the acids would be frequently absent in the urine. It is possible, therefore, that a want of discrimination of the nature of the cases examined has led to the belief in some writers of the constant absence of the bile-acids in the urine during Jaundice.

Dr. Murchison supports Frerichs' views. He believes that a great portion of all the constituents of the bile are normally absorbed into the blood from the intestinal canal and are at once transformed, so that neither bile-acids nor bile-pigment can be discovered in the blood, and there is no Jaundice; but that in certain morbid states the absorbed bile does not undergo the normal metamorphosis, circulates with the blood, and colors the tissues. He infers that the only difference between Jaundice with obstruction and Jaundice independent of obstruction of the common bile-duct is that, in the former case, none of the bile can escape from the body by the feces, and, consequently, all that is secreted after the gall-bladder and biliary passages are fully distended must be absorbed into the blood in quantities beyond its power of metamorphosis.[3]

Frerichs' theories depend upon the supposed absorption of bile from the liver and intestines; but it must be remembered, however probable this may be, that there is no positive proof of it, or that the biliary matters are not decomposed in the intestine.

It is impossible within the limits of this paper, nor would it be profitable in the present state of our knowledge, to enter into a detailed examination of the differ-

[1] Virchow's Archiv, vol. i.
[2] Virchow's Archiv, vol. xxxii. part i.

[1] Beale's Archives, vol. i. p. 350.
[2] Harley on Jaundice, pp. 59, 60.
[3] Murchison, Clinical Lectures on Diseases of the Liver, pp. 312, 313.

ent opinions held upon the causation of non-obstructive Jaundice, with regard to which both observation and experiment have given such contradictory and irreconcilable results. The whole subject requires further investigation before safe conclusions can be drawn.

It seems reasonable to suppose, however, that the secretion of the liver really is diminished in certain stages of non-obstructive cases. In many instances post-mortem examinations show a pale or clear state of secretion and an empty state of the ducts, which would imply that the secretion had been diminished before death; but it does not necessarily follow that, in the initial stages, suppression of secretion had occurred, and that this stood in the relation of cause to the Jaundice.

Whatever view we may take as to the causation of the yellowness of the skin, Jaundice is, in practice, divisible into two classes, as below. The greater number of cases of Jaundice are found to be in the second class.

A. Those dependent on obstruction. Retention of bile, wholly or partially, with absorption.

B. Those without obstruction. In these, according to many opinions, the Jaundice is due to suppression of secretion, owing to functional or structural disease of the liver; according to others, to insufficient metamorphosis of bile, or some change in the blood itself. There may be a mixture of these two classes, the first form merging into the second.

A. Obstructive Jaundice may depend on—

1. Catarrhal conditions, or thickening or swelling of the lining membrane of the gall-ducts, or of the mucous membrane of the duodenum, involving the mouth of the common duct.

2. Narrowing or occlusion of the ducts by permanent thickening of the lining membrane, or adhesions or cicatrizations of ulcers of the duodenum.

3. Compression of the canals from without by abnormal tissue.

4. Cancerous, hydatid, aneurismal, or other tumors, enlarged glands, abscesses of liver or pancreas, growths or enlargements of kidneys or ovaries or other parts, placed so as to press upon the common or other ducts.

5. Masses of feces in the colon pressing upon the duct.

6. Pregnancy in the later stages.

7. Lumbrici, hydatids, or foreign bodies entering the common duct, and becoming impacted in the passage.

8. Gall-stones blocking up the common duct or secondary canals.

9. Congenital deficiency of bile-ducts.

B. Non-obstructive Jaundice is met with under the following conditions:—

1. Lesions of innervation.
2. Congestions of the liver, active and passive.
3. Malarious fevers.
4. Relapsing and other fevers.
5. Pyæmia.
6. Poisoning by snake-bites, phosphorus, chloroform, &c.
7. Acute and chronic atrophy.
8. Diseases of the portal vein.
9. Excessive secretion of bile with reabsorption.

It is quite possible that in some of the forms of non-obstructive Jaundice, as in the forms with congestion of the liver, malarious and relapsing fevers, the cause may really be mechanical. A swollen and enlarged liver, by narrowing of the ducts or by altering their directions, may cause delay in the onward course of the bile, and permit of absorption and Jaundice. As before mentioned, Virchow[1] has lately advanced the opinion that a catarrhal or swollen state of the main ducts or plugs of mucus are the causes of Jaundice in many cases in which he had formerly attributed it to blood-changes.

Jaundice occasionally occurs epidemically. In these cases it is probably accompanied with congestion of the liver, and in some cases with catarrhal states of the duodenum, mostly due to some form of blood-poisoning.

The most recent classifications of the causes of Jaundice are given by Dr. Harley[2] and Dr. Murchison.[3] As they are exponents of opposite opinions, they are given below.

According to Dr. Harley's outline, they are—

Class A.—Jaundice from Suppression.
1. Innervation.
2. Disordered hepatic circulation.
3. Absence of secreting structure.

Class B.
1. Congenital deficiency of bile-ducts.
2. Accidental obstruction of bile-ducts.

Dr. Murchison's outline is as follows:—

Class A.—Jaundice from Mechanical Obstruction of the Bile-Duct.
1. Obstruction by foreign bodies within the bile-duct.
2. Obstruction by inflammatory tumefaction of the duodenum, or of the lining membrane of the duct, with exudation into its interior.
3. Obstruction by stricture or obliteration of the duct.
4. Obstruction by tumors closing the orifice of the duct or growing in its interior.
5. Obstruction by pressure on the duct from without.

[1] Archives, vol. xxxii.
[2] Harley on Jaundice, p. 20.
[3] Op. cit. p. 316.

CLASS B.—Jaundice independent of Mechanical Obstruction of the Bile-Duct.

1. Poisons in the blood interfering with the normal metamorphosis of bile.
2. Impaired or deranged innervation interfering with the normal metamorphosis of bile.
3. Deficient oxygenation of the blood interfering with the normal metamorphosis of bile.
4. Excessive secretion of bile, more of which is absorbed than can undergo the normal metamorphosis.
5. Undue absorption of bile into the blood from habitual constipation.

SYMPTOMATOLOGY AND PATHOLOGY.—It will be well, in the first place, to consider the effects of Jaundice generally, and afterwards briefly to notice the principal forms of the complaint, with the mode of discriminating them.

In the fully-formed stages the signs of Jaundice are evident enough in the yellowness of the external surface. This and most of the secretions are more or less of light yellow, yellow, dark yellow, dusky or greenish, or blackish green, according to the intensity of the Jaundice. The yellowness may become well marked, slowly or rapidly, within a few days or within twenty-four hours; a slight tinge of the conjunctiva or slight yellowness of urine being often discoverable before alterations of the skin; the order of succession of coloring being generally urine, conjunctiva, skin. Few of the tissues or secretions escape being colored during the progress of the disease, but the mucous membranes and mucous secretions are rarely tinged. Morbid collections of fluid, as dropsies and the serum of blisters, become yellow. The greatest amount of pigment passes off through the kidneys, and after that through the sweat-glands (Frerichs).

The urine in Jaundice changes both in color and composition. The colour depends on the bile-pigments, and varies from a light bright or saffron yellow to dark greenish brown or porter hue; the quantity often diminishes in the beginning of the Jaundice, owing to congestion of the kidneys; and afterwards is generally natural if the progress of the disease is favorable. The urine is acid, and besides bile-pigment may contain bile-acids (?), leucine and tyrosine. There are variations in the quantities of urea and uric acid, and sometimes they are greatly lessened. In the later stages of unfavorable cases sugar may appear (Harley). It seems that benzoic acid taken internally does not appear in the urine as hippuric acid. The urine need not be tested for the sake of diagnosis of the disease in well-marked cases of Jaundice, but in the incipient stages an examination might show that it was coming on. Dr. Harley states that, even when Jaundice is well established, examination of the urine gives valuable assistance in the diagnosis of important attendant conditions. In doubtful cases he says that it may help to decide between obstruction or non-obstruction by telling of the presence or absence of the bile-acids or of leucine or tyrosine, and it may give us information as to the state of nutrition by the variations in the natural constituents of the urine.[1] Dr. Murchison doubts both the chemical and clinical value of Dr. Harley's test for deciding on the presence or absence of bile-acids; chemically, because there is no attempt to separate the bile-pigments before applying the tests; and clinically, because it has failed in his hands.[2]

The chemical tests used for the detection of bile-pigment and bile-acids are as follows:—

For the coloring matter, a piece of white rag or white filtering paper dipped into the urine will have a yellowish tinge after drying, if there is any appreciable quantity of bile in the suspected urine. Nitric acid: if a few drops of nitric acid and of urine are placed separately on a white porcelain saucer or plate, and then held so that the two fluids can run together, a play of colors occurs at the line of junction of the two fluids, changing from violet to green, and ultimately to red. The colors fade away quickly.

For the bile-acids, Pettenkofer's test is used. To two drachms of urine a small piece of lump sugar and strong sulphuric acid are added, the latter slowly, and drop by drop, in order that the temperature of the fluid may be kept as low as possible. At the line of contact of the two liquids a deep purple hue develops itself if the acids are present; if there are none, the color is reddish or brownish-red.

Tyrosine and leucine are demonstrable by microscopic examination of the crystals produced in urine which has been carefully evaporated to the consistence of syrup.

In cases of Jaundice with obstruction, but less so in those without it, there is a deficiency or total absence of bile in the alimentary canal, causing a change both in the color and the composition of the feces. The bowels are generally constipated or sluggish. The stools are whitish or white, or clay-colored or gray, if the food is of the ordinary character; but, of course, many kinds of food or medicines,

[1] Harley, op. cit. pp. 58–89.
[2] Op. cit. p. 426.

as iron, mercury, &c., give some color to the feces, and this should be remembered when the evacuations are examined.

When the obstruction is partial there may be a tinge of yellow in the stools; and, of course, when the obstacle has given way there may be bile in the feces long before the skin becomes of natural hue. As already mentioned, the absence of bile in the stools is less marked in the non-obstructive forms: in pyæmia, for instance, they are generally yellow or of light yellow color.

The feces in Jaundice when free from bile are generally acid, have a disagreeable fetid smell, and may contain fatty acids which require bile for their emulsion; and when there is conjoined absence of the pancreatic secretion the neutral fatty matters may also be found unchanged.

There is little or no pyrexia in most cases of Jaundice, but it may occur in the catarrhal or congestive forms. The pulse is generally slow, sometimes descending as low as, or lower than, forty or fifty beats. In some fevers the Jaundice is preceded by a considerable falling of the pulse, which is probably due to the depressing effect of bile upon the heart. In some of the pyrexial cases there is fulness and enlargement of the liver.

These preliminary symptoms are sometimes very slight, and diminish in the course of the disease, but do not necessarily subside with the appearance of the Jaundice. Itching of the surface is a frequent derangement; according to Frerichs it occurs in about one-fifth of the cases. It is sometimes very irritating and difficult to relieve; it generally, but by no means always, ceases when the Jaundice is fully developed.

Among the rarer symptoms of Jaundice are yellow tears, sweat and milk, and, still more rare, yellow vision. Elliotson[1] relates a case in which there was yellow vision in one eye, but not in the other. The eye with yellow vision was affected with albugo, through which and across the line of vision ran two large vessels. Diarrhœa instead of constipation is sometimes met with.

The time which elapses between the establishment of the exciting cause and the appearance of yellowness of the surface varies. In some instances it comes on rapidly; cases are related of its manifestation immediately on the occurrence of the mental emotion which gave rise to it. It has been suggested that in these rapid cases less pigment passes off through the kidneys than usual, and it seems that in those in which it passes off in large quantities, the Jaundice may be delayed. We may suppose from Frerichs' data that in the obstructive cases the Jaundice is visible on the surface in about three days from the occurrence of the stoppage, though the pigment is seen earlier in the urine. It occurred within twenty-four hours in a case known to the author, in which it succeeded severe and prolonged sea-sickness in a voyage of nine or ten hours' duration.

In the early stages, the urine is sometimes lessened owing to congestion of the kidneys, and there is weight and uneasiness about the loins, but these symptoms generally soon subside; occasionally albumen appears in the urine.

In favorable cases without permanent obstruction, after a few days' duration the disease yields, free discharge of bile returns, and the stools assume their natural color; the digestion becomes good and the patient convalescent, though he often remains languid and thin for weeks, the yellowness slowly disappearing. Jaundice, however, may be a much more serious disease than this. The cholæmia, or associated blood derangements, may become greater, and the effect upon the system dangerous or fatal; causing convulsions, sopor-delirium, or coma, which may end in death; or there may be other alterations of the blood, showing themselves in petechiæ, purpura, ecchymoses, extravasation of blood, or hemorrhages from mucous or other surfaces; and, owing to impaired digestion, imperfect nutrition, great emaciation, and death by asthenia, typhoid symptoms, or collapse.

While the urine is copious and the kidneys healthy, the biliary matter passes largely out of the system—sufficiently so, indeed, in slight cases to prevent the surface from becoming yellow. If the kidneys fail to act, the bile and renal excretions, and probably various kinds of effete matter, accumulate in the blood, and the before-mentioned most dangerous consequences ensue.

Signs of irritation of the mucous membrane of the intestines, with evacuations of dysenteric character, and hemorrhage from the stomach and intestines, sometimes occur with great portal congestion both in the prolonged and in the more acute cases.

The causes of death in Jaundice may be summed up as—

1. Those affecting the nervous system, delirium, convulsions, coma.

2. Typhoid symptoms, asthenia, &c., exhaustion from impaired nutrition.

3. Hemorrhages from the intestinal and other surfaces.

There is great difference in the course of Jaundice. In some cases, as in the obstructive forms, it may last for years, the patient preserving a considerable degree of strength and vigor throughout. In

[1] Principles and Practice of Medicine, p. 102.

others, generally in the non-mechanical forms, it is fatal within a few days or hours. The cause of the differences of symptoms of these cases is of great interest and is by no means understood. The bad symptoms are not due to the mere presence of coloring matter, as this may circulate freely in the system for years without causing much mischief. It is probable that there is some end to the toleration of this substance, but it is difficult to say where it terminates.

Dr. Harley attributes the bad symptoms to the accumulation of bile-acids in the blood.[1] He found that six grains of glycocholate of soda injected into the femoral vein of a small dog killed it. The symptoms are not given. The experiments of Professor T. H. Albers of Bonn on frogs showed that in these animals injections of small quantities of glycocholic acid under the skin produced cramps, severe spasms, and death.[2] Other experimenters have found that animals operated on by injections into the veins died suddenly without assignable cause.

The results of these experiments, however, have not been uniform. Frerichs,[3] for instance, found that in his experiments the animals suffered very little from the injections of the bile-acid. Nevertheless, with all these discrepancies in the results of experiments, unless there is some great error, it does seem that the bile acids may be injected into the bloodvessels without serious disturbance.

The quantity of the acid tolerated seems equally uncertain. If the bile-acids are the cause of the violent symptoms, it would be difficult for the advocates of Jaundice from suppression to account for the severe and often fatal consequences which so often occur in this class of cases.

Dr. Budd[4] has suggested that the retention and decomposition of excrementitious matters from which probably the acids are formed, or decomposition of the retained principles of bile, or the development of some new animal poison in the liver, may give rise to the dangerous symptoms; but of this there is as yet no proof.

Dr. Murchison says that the severe cerebral symptoms which occur in those cases of the so-called suppression of bile are probably due to imperfect metamorphosis of the materials from which the urinary solids are derived, and which seem to require the presence of bile in the blood to complete them. Urea is not formed in sufficient quantity, and substances such as leucine and tyrosine, of intermediate composition between it and the proteine compounds, accumulate in the blood and appear in the urine.[1]

The emaciation and anæmia attendant upon prolonged Jaundice probably depend upon the absence of bile in the intestines, and the consequent interference with the emulsion of food and absorption of nutriment by the lacteals.

From defective absorption and nutrition probably depend the change of the blood in the chronic forms, but this would hardly account for its rapid impoverishment and solution in the acute cases in which these blood-changes appear so speedily.

Post-mortem Appearances. — The morbid changes connected with Jaundice, irrespective of the cause of the disease, are to be found in the liver itself, and in distant fluids, tissues, and organs. In this section the condition common only to all forms of Jaundice will be mentioned. The state of the liver itself varies with the different kinds of Jaundice, and will be noticed under their respective heads.

The serum and clot of the blood are yellow from bile-pigment, the fibrine in the advanced stages of the disease soft and badly coagulated; the altered condition of the blood is evident in the petechiæ, ecchymoses, and extravasations of blood, found in various parts of the surface and organs apart from the seat of congestions. The bile-acids are not traceable in the blood, having been probably rapidly decomposed therein. Nevertheless, if, as asserted, they are to be found in the urine, in obstructive cases, they ought not to be absent from the blood in such cases during life. Frerichs states that he and Dr. Valentin had frequently examined blood obtained during life by venesection, and also that from the dead body, without finding the acids. The white globules are generally in excess, the red globules are commonly large, with a tendency to adhere together and looking as if acted upon by some chemical agent. Nearly all the tissues are yellow. The skin is most affected, the pigment being deposited in the deeper layer of the epidermis, the sweat-glands being deeply stained. The color is well marked throughout in the adipose, serous, areolar tissue of bloodvessels, lymphatics, the substance of the bones and teeth; the brain and nerves are less frequently dyed, and the mucous membrane very seldom.

The kidneys are affected not only by being colored but by morbid changes due to irritation of, and deposits in, the parenchyma. In the earlier stages they are often enlarged and congested, and the secreting cells loaded with bile. According to Frerichs, in chronic cases the kid-

[1] Harley, op. cit. p. 39.
[2] Virchow's Archiv, 1862, p. 582.
[3] Frerichs, op. cit. vol. i. pp. 394, 395.
[4] Budd, 2d edition, pp. 263, 264.

[1] Murchison, Clinical Lectures, p. 314.

neys become of an olive-green color; the uriniferous tubes coiled up and of dark color, the pyramidal tubuli-brown or sap-green, or black from deposit. When the deposit is most intense the uriniferous tubes may be observed to be distended with a coal-black brittle mass which may or may not be soluble in caustic potash, or there may be cylindrical masses of amorphous material, brown in the centre but becoming gradually pale towards the periphery. Caustic potash causes them to swell up like coagulated fibrine which has been retained a long time in the uriniferous tubes; the pigment may be deposited throughout the substance of the kidneys.[1] Dr. Harley[2] describes the surface of the kidney after removal of the capsule as having the appearance of being sprinkled with ink when the renal capillaries are choked up, the black specks varying in size from the minutest visible form to a pin's head. In the drawing of a case given by him the kidney is represented as very much enlarged and studded with small abscesses.

In Jaundice of pregnant females the fœtus becomes jaundiced also if sufficient time be allowed. Frerichs states that he has not noticed it in cases in which the mother's disease has lasted from five to fourteen days.

VARIETIES OF JAUNDICE: JAUNDICE WITHOUT OBSTRUCTION.

JAUNDICE WITH CONGESTION OF THE LIVER.—This occurs in the active and passive forms.

Active Congestion.—Jaundice of this class is met with in warm climates and in the warm weather of temperate climates, but its occurrence is not restricted to hot weather. The symptoms are more or less uneasiness or sense of fulness or weight about the right hypochondrium. The liver is always more or less, sometimes considerably, enlarged, so that its edge can be felt below the margin of the ribs, but its size is not always sufficiently increased for this, though its increase is recognizable by percussion. There may be uneasiness or pain, sometimes pretty severe, increased by pressure or by lying on the left, and sometimes even by decubitus on the right side, and pain in the right shoulder or under the right shoulder-blade. A bitter taste in the mouth is often perceived, and nausea, furred tongue, and the other signs preceding Jaundice. The stools may be pale or white, but sometimes contain bile and are sometimes loose. The Jaundice begins in two or three days after the onset of the symptoms. There is in most cases some pyrexia and quick pulse. This disease is generally not severe, but it occasionally runs a dangerous or even fatal course. The patient often emaciates during its progress, and his convalescence is slow. This form of Jaundice is frequently complicated with congestion of the mucous membrane of the biliary passages. In some cases it is very difficult to distinguish it from the Jaundice which comes on in fevers or from the catarrhal forms of icterus. The congestion sometimes affects part of the liver only.

Passive Congestion.—This is the consequence of disease of the heart or lungs. It is occasionally met with in acute thoracic diseases causing retardation of the passage of blood through the lungs or heart, as in extensive pneumonia or pericarditis with effusion. It most commonly occurs, however, in the advanced stages of chronic heart diseases. The Jaundice is often well marked and persistent; the stools are not always pale. This variety of icterus belongs to heart or lung disease, and need not be further treated of here.

Jaundice from congestion of the liver is included in the section of non-obstructive disease, in compliance with the usual opinion which places it in the class of suppression; but it seems probable that many of these cases both of acute and chronic character ought really to be placed among the obstructive forms. With enlargement of the liver there is more or less pressure on, and narrowing of, the canals, and probably some alteration of their direction. If in this condition secretion of bile goes on, and in some stages of congestion it is freely secreted, it will be more or less retained sufficiently long in the passages for considerable absorption to take place. This might not be apparent after death, and on examination the bile-passages might seem to be of natural calibre and pervious. It is true that Jaundice does not necessarily occur in all forms of enlarged liver, as in the waxy or fatty forms, but in these secretion is probably much less active than in some stages of the merely congested liver.

JAUNDICE FROM MENTAL EMOTION.—There are numerous cases on record in which this appears to have occurred. The mental emotions which have been known to bring on Jaundice are grief or anxiety, anger or fright. It has been reported in certain cases to have appeared very suddenly, immediately upon the occurrence of the mental emotion. The older writers supposed it to be due to spasm of the gall-ducts or common duct. It is, however, hardly possible to conceive

[1] Frerichs, vol. i. p. 102, and Atlas, part i. plate i.

[2] Harley, op. cit. p. 57.

a spasm of the common duct which would be persistent enough to arrest the bile sufficiently long for absorption. This Jaundice would be attributed to suppression of secretion from deranged nervous influence by some writers, and by Frerichs and others to increased formation and absorption of bile, or to diminished metamorphosis from the same cause. Dr. Bence Jones shows how this form of Jaundice might arise owing to increased formation of bile through nervous disturbance, especially if at the same time there was interference with the condition of the blood. Referring to the experiments of Claude Bernard on the secretion of the salivary glands, he says: "It is very probable that the sympathetic nerve in the liver if tetanized would stop the circulation by contracting the small bloodvessels, and this would diminish the secretion of bile, whilst the branches of the pneumogastric which enter the liver, when stimulated, would relax the small bloodvessels, and thus cause a more rapid circulation through the liver, from which an excessive formation of dilute bile would result."[1] Dr. Murchison thinks that this Jaundice is due to diminished metamorphosis in the blood. The disorder has appeared more frequently when the cause has operated directly after a meal, and, preceded by a sense of weight or uneasiness at the epigastrium, and a feeling of sinking and difficulty of breathing. Bamberger attributes the symptoms to a nervous disturbance of the stomach and duodenum, which causes a catarrhal state of the mucous membrane of the duodenum.[2] It seems impossible that the rapid icterus could be produced in this way. The yellowness generally subsides after three or four days, and the disease is usually a light one; but it has been known to terminate fatally, with convulsion or other lesion of the nervous system. It appears that in some fatal cases the liver has undergone changes similar to those met with in the graver forms of icterus, to be mentioned presently.

MALIGNANT JAUNDICE.—There is a group of cases of very fatal nature characterized by the rapid progress of the worst symptoms of the disease. They are described by Dr. Budd as cases of "fatal Jaundice," by Lebert[3] as "Icterus typhoides," and are mentioned also by Graves.[4] Many of these cases were connected with some stages of that condition of the liver known as acute yellow atrophy, and must be left for consideration in that article, but as they are not necessarily connected with that affection, it will be fitting to mention the characteristics of the group here.

These cases may begin without severe symptoms, and without any apparent reason pass into the most dangerous conditions. In others the dangerous symptoms show themselves from the first.

There may be pain and uneasiness in the hypochondrium or epigastrium after or with slight feverishness, and then, after a short interval, rapid onset and progress of Jaundice with coma and other symptoms of disturbance of the nervous system, hemorrhages into the intestinal canal, serous cavities, or other tissues, petechiæ, and extravasations of blood into the cellular tissues. The blood-changes come on very rapidly, and are characteristic. Head-symptoms are very frequent, and generally set in early. Coma does not always occur; a certain number of cases die under typhoid symptoms or exhaustion. In the beginning of the disease the pulse may be slightly accelerated, but as the illness advances it gains in frequency and loses strength, and in the last stages is subject to great fluctuations within the twenty-four hours. Nausea and vomiting are frequent, and in some instances the vomited matters are dark and grumous, resembling what is known as black vomit. The bowels may be constipated, but diarrhœa is not very uncommon, the evacuations pale or clay-colored, but they are not always devoid of bile. Taking the three classes of symptoms which attend Jaundice, it seems that they are all intensified and rapid in their advent and downward progress; as might be expected, a very large proportion of these cases die, so that the disease deserves the name of fatal or malignant Jaundice. Its duration is generally short; few of the cases which end fatally survive the third, but probably the majority of them die within the first, week. Some of these cases are, doubtless, attended with acute atrophy, as the liver is found diminished in size, but many of them of a severe character, and even of some duration, are unattended with change of form or size of the liver. In the fatal cases the tissue of the liver is soft and easily torn, all the gall-ducts pervious, but without biliary secretion or containing thin green bile only; the cells in the greater part of the liver, and frequently throughout, more or less altered, more or less indistinct or broken down, sometimes quite untraceable, and such cells as can be distinguished not dyed with bile. This severe affection most frequently attacks people below the middle age, and is occasionally met with

[1] St. George's Hospital Reports, 1866, page 193.

[2] Virchow's Handbuch der speciellen Path. und Therapie, vol. vi. part i. 2d half.

[3] Virchow's Archiv, vols. vii. and viii., 1855.

[4] Clinical Lectures by Neligan, page 633.

in the earlier stages of pregnancy. It has been confounded with yellow, bilious, and typhoid fevers. Excellent illustrations of this form of Jaundice may be met with in the works already mentioned, and to them the reader is referred for further information.

[*Epidemic* Jaundice was reported upon by the medical officers of the U. S. Army during the civil war. Of over 10,000 cases occurring, 40 were fatal.—H.]

The description of Jaundice occurring in the forms of blood-poisoning met with in the course of fevers, pyæmia, poisoning by phosphorus, &c., finds place under these diseases; to describe them in detail would occupy too much space here. In most of them there is some disordered circulation in the liver; in some, as in Marsh fevers, there may be congestion and enlargement; in typhus, typhoid, and relapsing, and other fevers of Europe, the probability is that there is no great change of size. In poisoning by phosphorus there is fatty degeneration.

Dr. Morehead met with 28 cases of Jaundice in 114 cases of remittent fever in natives of India. In some of these there was enlargement of the liver and biliary congestion with tenderness below the margins of the seventh, eighth, and ninth ribs. In six of the cases there were traces of inflammation of the mucous membrane of the duodenum or stomach. He concludes that inflammation of the duodenum has an important relation to Jaundice in remittent fevers, but he has not found evidence of congestion or inflammation of the biliary passages.[1] The late Mr. Twining attributed Jaundice in many of these cases to the pressure of certain neighboring enlarged glands upon the common duct.[2] Dr. Morehead, however, has not seen confirmation of this view in his cases, because, though he found these lymphatic glands enlarged in six out of ten cases, he saw no reason to suppose that in any except one had they exerted any pressure upon the duct.

Virchow thinks that the Jaundice in pyæmia, typhus, &c., depends upon catarrhal states of the biliary canal, and therefore belongs to catarrhal icterus. He believes that the portion of the common duct which runs between the coats of the duodenum, and which he calls the intestinal portion of it, plays the chief part in producing the Jaundice. He says that it is often closed during life by œdema and turgescence which disappears after death, or it is obstructed by a plug of colorless mucus which may be squeezed out by gentle pressure on the duct, but not by pressure on the gall-bladder; the passages behind the plug are widened and stained with bile, the intestinal portion being narrowed and pale. It is quite possible that many cases have occurred, in which morbid changes in the bile-passages were evanescent or not recognized owing to hasty observation, which may really have been instances of catarrhal icterus coming on in the course of the primary disease, and should be considered as belonging to the obstructive, instead of to the non-obstructive class.

A full consideration of the morbid changes in cases in the class of Jaundice without obstruction shows that there may not always be such an absence of obstruction as is generally supposed. In some of the cases of blood-poisoning it is likely enough that no impediment existed at any time, but the number will be considerably reduced if the congestion cases be looked upon as mere instances of arrest of bile in the passages, or, at any rate, of sufficient delay therein for absorption to occur, and if the catarrhal states be proved to be more frequent and effective than is now considered to be the case. If the Jaundice depended upon deficient metamorphosis only, it ought, one would think, to be more frequent in cases of malignant fevers than it seems to be. It is evident that in many cases of fever the catarrhal state has an important effect in producing the result. In many cases of blood-poisoning the secretion of bile, or at any rate, of its colored part, goes on. How far this may be due to the action of a part of the liver only has not been ascertained. This continued secretion appears pretty certain, because the gall-bladder is frequently found full of bile after death, and in some cases there is biliary congestion, as, for instance, in many of Dr. Morehead's cases. In some instances, however, there does appear to have been a deficiency of secretion. The condition of the liver itself in these cases without obstruction varies. It may be enlarged, much diminished, or of about normal size, its texture soft and friable and easily broken down, and the color pale or mottled, the cell-structure broken or disintegrating, not bile-stained or saturated, as in obstructive Jaundice. Virchow considers that the absence of pigment in the cells would be indicative of want of obstruction. It would be found in the uninjured cells in cases in which obstruction had come on from catarrh. Leucine and tyrosine are often found in the substance in the liver. An acid state of the liver was found in a case related in Dr. Budd's work.[1] The spleen is often enlarged and softened, and the kidneys generally

[1] Researches on Diseases of India, 2d edit. p. 97.

[2] Twining, Diseases of India.

[1] Op. cit. p. 258.

altered in size and consistence, bile-stained, and often with excess of epithelium in the tubules.

JAUNDICE WITH OBSTRUCTION.

This may be acute or chronic, temporary or permanent, partial or complete. The most characteristic signs are met with in the complete and permanent forms.

The acute forms are well illustrated by the cases in which the passage is obstructed by swelling or turgescence of the mucous membrane of the bile-ducts, or of the duodenum along the tract on or about the mouth of the common duct; also where a gall-stone slips forward into the common duct, bars the passage for a time, and either passes onwards into the intestines or slips back into its bed, in either case freeing the channel. In these cases Jaundice is both acute and temporary. It may be intermittent when a calculus at intervals slips backwards and forwards or when a series of calculi pass onwards at sufficient intervals of time. The complete form is illustrated when a gall-stone becomes permanently impacted in the common duct, or when some tumor or morbid tissue constricts the duct entirely, preventing the passage of bile. The partial form of retention may exist when a gall-stone only partially blocks up the common duct, allowing part of the bile to pass onwards; or when it completely stops up one of the large branches of the duct, imprisoning the secretion of a section of the liver only.

Permanent Obstructive Jaundice.—When this has become fully established the liver undergoes extensive changes; at first enlarging and afterwards diminishing in size. The stage of enlargement is due to the accumulation of bile in the ducts and gall-bladder, and to congestion of the tissue. The liver enlarges in all its dimensions, its edge with sharp outline may be readily felt below the ribs, and its depth of dulness, in the sternal, mammary, and axillary lines evidently increases. In extreme cases the measurement in the mammary and axillary regions may reach respectively two, three, or more inches above the normal standard, and the edge may be felt below the level of the umbilicus. In some cases the gall-bladder attains a great size, and may be easily recognized by the eye and by touch, as a round tumor projecting under the margin of the liver. Frerichs has not found it to contain more than eight to sixteen ounces of fluid; but larger quantities have been met with. Under the great distension the gall-ducts become dilated and thin, the diameter of the main duct being sometimes enormously increased, and the whole of the ducts throughout the liver may be distended.

After remaining stationary or variable for perhaps five or six months, the liver begins to diminish, the secreting tissue becomes impaired and atrophic. By degrees bile ceases to be secreted, while at the same time the contents of the ducts are absorbed and partly replaced by thin secretion containing little bile. The diminution of the liver may be traced by percussion. In the later stages the organ is reduced below the natural size, and in extreme cases, owing to atrophy of the secreting tissue, may be converted into little more than a cyst.

Symptoms.—This form of Jaundice may set in with marked symptoms, as in the case of gall-stones or obstruction by entozoa, or it may come on slowly without marked signs, as in compression by tumors. It may be attended with the signs of cholæmia already stated. The yellow color is usually deep—deeper and fuller than in the non-obstructive forms, gradually increasing for some time, but afterwards lessening. The appetite and digestion are often very good at first. The bowels are generally constipated, and the stools white and free from bile. In the later stages there may be portal congestion, dysenteric stools, and hemorrhages from the intestinal canal, independent of the general hemorrhagic tendency from impaired nutrition. The Jaundice sets in quickly after the complete establishment of the obstruction, within three or four days. Under favorable circumstances the disease may run a very chronic course, in some cases lasting for years. From imperfect nutrition, the patient may emaciate and waste, owing to the complete absence of bile in the intestinal canal; the blood may become impoverished by degrees; and, as the secreting tissue of the liver wastes, acholia may ensue.

The symptoms of the associated cause will, of course, vary greatly with the nature of the obstruction. This will be referred to in the paragraphs on diagnosis. Though in occlusion of the ducts in non-malignant disease the downward progress of the case may generally be slow, yet it may become rapid from accidental suppression of urine, or from symptoms affecting the nervous system, hemorrhage into the bowels, or peritonitis from rupture of the gall-bladder or ducts. The prognosis is also affected by the nature of the associated disease.

Morbid Anatomy.—The changes found in the liver after death depend of course upon the stage of the disease at the time. In the earlier stages, say where the obstruction has lasted a few weeks, we find it much enlarged in all directions, of olive

green or brownish green color, or mottled from bile-staining; the ducts distended with secretion; the hepatic cells grouped round the intra-lobular veins, tinged or clotted with bile pigment; the nucleus sometimes dyed yellow; the peripheral cells of the lobules pale or scarcely tinged; sections of the liver have a marbled appearance, from the different degree of staining of the central and peripheral hepatic cells.[1]

If the obstruction has lasted longer, say for six or more months, the liver is deeper and more uniformly colored. The peripheral cells have also become colored; the finest capillary ducts are filled with bile. In these are deposited minute microscopic bodies, mostly rod-shaped or branched, which lie in the minute network of the capillary ducts and sometimes form casts of the capillary network. With still longer stasis in the capillary bile-ducts the bile crystallizes in irregular, ruby red, shining bodies, which have not the form of crystals of hæmatoidin.[2] The inter-lobular ducts contain inspissated bile mixed with epithelial cells from their walls, forming small concretions, and the ducts are often lined with a compact tubular dark-brown mould or cast,[3] while the duct-walls are thickened. The enlarged ducts can be followed throughout the substance and even on the surface of the liver, and are often varicose or irregularly dilated. The degree of dilatation of the ducts is sometimes enormous; thus Frerichs mentions a case in which the diameter of the common duct reached one and a half inches in diameter, the cystic duct eleven Paris lines, the hepatic duct twenty-two, and one duct in the right lobe seventeen.[4]

In old cases, and when atrophy of the secreting tissue has taken place, the gall-ducts and passages contain a clear slimy mucous secretion, which has replaced the absorbed bile, and, indeed, in some instances the fluid has quite lost all the chemical reaction of bile. When destruction of the secreting tissue has far advanced the liver has a shrivelled or collapsed appearance, and the weight is considerably reduced.

The condition of the hepatic cells in permanent obstruction differs from that in the non-mechanical Jaundice. If examined sufficiently early after death, say within twelve or eighteen hours, they are not found broken up, but they may be granular, and the nucleus obscured. In advanced cases they shrivel up so that the largest cells found are smaller than the smallest normal ones. They have generally lost one-half or one-third of their natural measurement.[1] Decomposition sets in with unusual rapidity after death in Jaundice, and hence unless the liver is examined immediately after death, the cells will be found to be either altered or broken up. This shrivelling up of the cells is not always found. Dr. Budd[2] gives an instance of obstructive Jaundice from closure of the common duct, in which the cells were examined by him in the early spring, twenty-two hours after death, and found to be broken up; the liver-tissue contained numerous oil globules. In these cases probably disintegration and suppression had come on in the course of the obstructive disease.

JAUNDICE WITH OBSTRUCTION FROM CATARRHAL STATES OF THE DUODENUM OR BILIARY PASSAGES.—These affections are sometimes met with singly, but they are often combined in the same case, the congestion commencing in the duodenum and spreading to the bile-passages. When commencing in the duodenum, the Jaundice is preceded by uneasiness at the epigastrium increased by pressure, dyspepsia, nausea, flatulence, bitter taste in the mouth, furred tongue, loss of appetite, and general debility, and often relaxed bowels, with some feverishness. These symptoms exist for a few days, sometimes for two or three weeks before the obstruction is established and the Jaundice appears. The congestion and swelling of the mucous membrane of the duodenum shuts up the mouth of the common duct. When occlusion is complete, the stools are clay-colored or white. This disease often spreads along the common and other ducts. When the congestion begins in the passages the symptoms are more obscure. There is less disturbance of the gastric functions, but there is uneasiness in the right hypochondrium, some pyrexia, and sometimes enlargement of the liver from biliary and vascular congestion and feverishness. When the inflammation involves both sets of tissues, the symptoms are a combination of those of both affections.

The congestion and swelling may last a few days, or even two or three weeks, and then, with subsidence of the turgescence, the passage is set free and the bile resumes its course. Frerichs saw a case which lasted three or four months.[3]

The catarrhal is perhaps the most common form of simple Jaundice, and is often associated with hepatic congestion. It is frequently met with in young people, and

[1] Frerichs, op. cit. vol. i. p. 131.
[2] Wyss, Virchow's Archiv, April, 1866, p. 557.
[3] Frerichs, vol. i. p. 116.
[4] Op. cit. vol. i. p. 139.

[1] Wyss, Virchow's Archiv, April, 1866, p. 359.
[2] Op. cit. p. 211.
[3] Op. cit. vol. ii. p. 443.

is generally a curable affection. A fatal case of the inflammation of the common duct is related by Andral.[1] In this the inflammation produced complete obstruction, distension and rupture of gall-bladder, and death at the end of eleven days. In catarrhal icterus the color of the surface is generally deep.

Jaundice from the Entrance of Entozoa or Foreign Bodies into the Common Duct.—This is very rare. Dr. Morehead mentions two cases. It is not easy to diagnose this condition. Inflammation is produced in the passages by the entrance of these bodies, and the symptoms are pain, sometimes severe, in the hypochondrium or epigastrium, with more or less pyrexia, and less disturbance of the functions of the stomach or duodenum than in catarrhal icterus. Hydatid cysts have been known to open into the gall-bladder or ducts, and to produce obstruction by hydatids being lodged in the common duct.

Epidemic Jaundice.—There is no special form of icterus with this character. It is not a very unusual circumstance to hear of several cases of Jaundice occurring in succession in a family, but in other instances the disease has appeared in a decidedly epidemic form in a district. Several severe epidemics, and some of them of a very fatal nature, are on record. In some of them, women in the early months of pregnancy suffered in a larger proportion than the rest of the community.

Epidemic icterus is most frequently prevalent in warm climates, or in warm summers in temperate climates, but is not confined to these; a widely-spread epidemic occurred at Rotherham in the winter of 1862–63.

A few of the epidemics may be noted. Dr. Watson mentions the prevalence of several cases of icterus in 1849. Dr. Morehead notices a sort of epidemic in the 1st Bombay Fusiliers in 1844. One occurred in the Island of Martinique in 1858. Numerous epidemics are mentioned by Frerichs, Lebert, and Copeland.

As above mentioned, no particular form of Jaundice can be called epidemic. Generally, however, it has some connection with blood-diseases, or with gastro-duodenal catarrh, or congestion of the liver. Probably the two latter conditions are the most frequent causes, so that epidemic icterus is frequently connected with temporary obstructive disease, the gastro-duodenal catarrh being part of some general disturbance of the system due to constitutional causes.

Jaundice with Excess of Bile: Polycholia.—This is probably not frequent, but occurs sufficiently often to require notice. In this there is excessive secretion of bile, and excessive absorption without mechanical impediment, so that the blood becomes impregnated with bile faster than it can be got rid of by the secreting organs. In this, with the usual symptoms of Jaundice, there is bile in the evacuations, and sometimes bilious diarrhœa. Dr. Murchison thinks that the Jaundice is greater when, with excessive secretion, there is constipation. He attributes the Jaundice to the presence of more bile in the blood than can be transformed by the normal metamorphosis.[1] This form of Jaundice is sometimes, perhaps not unfrequently, associated with congestion of the liver.

Jaundice in New-born Infants.—This may be due to much the same class of causes as those which operate in the adult; they may be catarrhal conditions of the passages or stoppage by inspissated bile or congenital deficiencies or obliteration of the passages, pyæmia, blood-poisoning, &c., or the result of a cold or vitiated atmosphere. The symptoms are much the same as those of the adult in the obstructive forms, deeply-colored skin, conjunctiva, and urine, with white evacuations. It may be remembered that the yellowness of the surface, which is so frequent in new-born children, is really not Jaundice, but due to physiological changes occurring in the blood in the skin. In these cases the conjunctiva and urine are not yellow, and the intestinal discharge is natural. In many instances Jaundice in children is a very serious disease, especially when associated with peritonitis, or enteritis, or phlebitis of the umbilical veins. In these cases oozing of blood from the granulations of the surface of the navel often takes place, and is generally fatal. The blood does not coagulate. Congenital deficiency of ducts is fatal, though life may be prolonged for a few months.[2]

Duration.—From the foregoing it will have been seen that Jaundice is a disease of very different degrees of duration. The simple or common forms of acute Jaundice run a favorable course of ten days to two or three weeks, and are rarely prolonged much beyond. The graver forms of non-obstructive icterus last a few days; the majority of the cases end within a couple of weeks; but some have been protracted to three or four weeks. Cases with yellow atrophy have ended fatally within two days. The duration is longest in cases of permanent obstruction, espe-

[1] Budd, 2d edit. p. 184.

[1] Op. cit. p. 403.

[2] West, Diseases of Children, 4th edition, Lecture xxxv.

cially in the non-malignant forms, when it may extend to many months, or even years, without seriously affecting the system. In these cases the balance of comparative health is probably maintained by free secretion through the kidneys and other organs. Drs. Budd, Graves, and Frerichs mention cases of extreme duration. The class depending on malignant disease are, of course, liable to quicker progress, seldom or never extending beyond five or six months; indeed, the duration of Jaundice constantly depends upon, and is influenced by, the associated conditions of the system. The duration may be accidentally shortened by rupture of the gall-bladder and its consequences.

Age.—There is perhaps no age exempt from Jaundice. The new-born infant may have it if the ducts or passages are imperfect. Young persons are subject to the gastro-duodenal and congestive form; the middle-aged to the obstructive, from gall-stones or cancer. It may appear in any age when it is an intercurrent affection in the course of fever and blood-poisoning.

Diagnosis.—There can be little doubt about the existence of Jaundice when fully formed. Anæmia, chlorosis, and malignant disease may give a sallow or lemon tint of surface, which may be confounded with the lighter forms of icterus. In these, however, the conjunctiva remains white and the urine free from bile-pigment.

It may be well, and especially when epidemic Jaundice is prevalent, in all cases of persistent gastric disturbance and malaise, to examine the conjunctiva and the urine and the right hypochondrium. By so doing, early indication of the approaching condition may be obtained.

The difficulty in cases of Jaundice is to decide upon the etiology or class to which they belong; to decide between Jaundice with and without obstruction. If hereafter proved to be thoroughly reliable, Dr. Harley's test of the presence or absence of bile-acids in the urine might be used. At present, however, the chief and almost only condition to be trusted to is the color of the stools. If there be bile in them, there cannot be complete occlusion of the common duct. Those who believe in the suppression of bile as a cause of Jaundice would argue that the stools may also be pale from non-secretion of bile. As a rule, however, it may be considered that pale or colorless stools in the early stages of the disease indicate obstruction to the passage of bile into the intestine. Tyrosine and leucine found in the urine denote non-obstructive disease.

The Jaundice which comes on in the course of pyæmia and other blood-poisonings, as in fevers, malarious enlargements, active and passive congestion of the liver, &c., leaves less room for doubt as to its nature if the patient's history and the state of the hepatic and gastric symptoms be duly weighed. If there be obstruction, it is of the catarrhal form. In the more acute forms of non-obstructive Jaundice not following fevers or recognized blood-poisoning, there may be difficulty in deciding upon the exact character of the hepatic lesion. That related to yellow atrophy may be inferred from the rapidity of course and gravity of the symptoms, the early advent of deep Jaundice, of tyrosine and leucine in the urine, and the rapid diminution of the size of the liver during life, as shown by percussion—due allowance being made for the tympanitic condition of the intestines which often coexists. Jaundice from active congestion may be recognized by the uneasiness and tenderness in the right hypochondrium and the enlarged state of the liver, recognizable in many cases both by palpation and percussion. Cases of passive congestion are recognized by the local signs and the history of chest-disease. The catarrhal states are diagnosed by deeper color, the gastric and duodenal disturbances preceding the Jaundice, some degree of pyrexia, and white stools. In later stages some congestion of the liver often comes on, and there is enlargement of the liver. In Jaundice from congestion the enlargement precedes the Jaundice, or is noticed simultaneously; in catarrhal icterus the enlargement of the liver succeeds the Jaundice.

Nervous Jaundice is recognized by its rapidly succeeding the mental disturbance which originates it, and in the absence of local signs.

There may be difficulty in deciding upon the exact local cause of permanent obstruction. The diagnosis is helped by the history and present condition of the patient; in tracing causes, the condition of the liver and surrounding parts should be carefully examined by touch, auscultation, and percussion.

A severe attack of pain in the hypochondrium and epigastrium accompanying Jaundice, with a history of previous attacks of acute pain in the epigastrium or hypochondrium without fever, and with or without Jaundice, would lead to the inference of obstruction by a gall-stone; there may, however, have been no previous attack of pain or Jaundice. It is possible that the enlarged gall-bladder may be felt as a small round tumor projecting below the margin of the ribs or the margin of the liver itself; an enlarged gall-bladder indicates obstruction.

A history of an attack some time previously of pain in the epigastrium or right hypochondrium, increased by pressure, with feverishness and with perhaps,

slight non-persistent Jaundice and subsequent indifferent health, would lead to the inference of obliteration of the common duct by external inflammation, or bands developed external to the common duct, and ending in contracting upon and compressing the canal.

Past symptoms referable to the duodenum, as pain three or four hours after eating without much vomiting of food, would probably indicate the existence of an old cicatrized ulcer of the duodenum near the common duct, which by contracting had shut up the mouth of the duct.

Indications of a cachectic condition of the body may lead to the suspicion of cancerous tumors or growths pressing upon the common duct. The appearance of melanine in the urine might indicate melanotic disease.[1] Careful local examination of the liver and surrounding parts might throw great light upon the cause of obstruction; we should examine carefully the liver itself, and especially its margin. The neighboring regions should be carefully scrutinized for the presence or absence of abnormal swellings, aneurisms, masses of feces, pregnancy. In looking for aneurisms the course of the aorta along the spine should be auscultated, and care is required to avoid mistaking the natural pulsations transmitted by an enlarged liver for aneurisms, an error occasionally made. Some assistance in discovering the seat of obstruction is rendered by the consideration of the degree and manner in which the function of neighboring organs is involved. Thus a growth which closed both the pancreatic duct and the common duct might be in the head of the pancreas itself; in this case neutral fats would not be digested.[2] Tumors pressing both on the portal vein and common duct would cause both Jaundice and ascites without general dropsy. In obstruction acting on the common duct the liver is uniformly enlarged, and its edge smooth; an obstruction barring a branch only would cause local enlargement. A knotty or tuberous state frequently attends cancer. The position of the enlarged gall-bladder may often be ascertained by touch, and be felt readily two or three inches to the right of the median line, projecting beyond the margin of the liver, and moved by the action of respiration. It is a good plan when examining the size of the liver to place the fingers flat, but not rigidly upon the abdominal walls a little below the margins of the ribs, and to cause the patient to take slowly a deep inspiration. With the descent of the diaphragm the margin of the liver is brought within reach of the fingers, and its position and size often made out most distinctly when other methods fail. The edge glides in an unmistakable manner under the fingers; the roundness or sharpness and position of the edge are thus readily recognized. Jaundice from the pressure of cancerous glands beyond the reach and touch would be difficult to make out. It might be suspected when, without any preceding history of gall-stones or perihepatitis, and absence of recognizable tumor, there is quick emaciation or a cachectic appearance.

The diagnosis of entozoa in the duct can never attain certainty; sudden coming on of Jaundice, with pains and signs of inflammation about the gall-bladder and ducts with pyrexia, have been noted in some cases which have proved fatal. In cases of hydatid enlargement it may be guessed that an hydatid has opened into the gall-bladder, and that a small cyst obstructs the duct, if with pain and feverishness Jaundice suddenly comes on; and the probability is increased if a hydatid should pass with the evacuations and the icterus pass off. With the greatest care there must still be cases in which exact diagnosis is impracticable—such, for instance, as obliteration of the duct by slow inflammation unattended with recognized symptoms, small abnormal growths, or a small scirrhous tumor in the duodenum, as in Frerichs' sixth case.[1]

It will be noticed that in the diagnosis some degree of fever, pain, or uneasiness precedes and attends those forms which are attended with congestion and catarrhal states. Severe pain without fever attends obstruction from gall-stones. There may be some fever in the onset of the malignant forms, but their rapidly bad progress soon decides to what class they belong.

For more minute details of diagnosis than can be given here, the works of Professor Frerichs, Dr. Harley, and Dr. Murchison may be consulted with great advantage.

Prognosis.—Most of the cases of simple Jaundice have a favorable termination, but when the Jaundice is well pronounced there must always be some degree of doubt as to the result. The kidneys may at any time become congested, and ceasing to eliminate effete matter, become a source of great danger. Free discharge of deep-colored urine is of good omen. Sometimes dangerous symptoms set in even in cases which begin to all appearance favorably; still, on the whole, cases of catarrhal Jaundice, or those with slight active congestion of the liver, are of good prognosis. Among the dan-

[1] Harley, p. 68.
[2] Frerichs, vol. i. p. 137.

[1] Harley, p. 55.

gerous circumstances are all typhoid conditions, fluctuating pulse, and symptoms involving the nervous system, as convulsions, delirium, coma; also great emaciation, undigested food in the stools, ecchymoses, purpura, hemorrhages from the alimentary canal, or dysenteric evacuations, ascites, diminution of urine, and of the excretion of urea, and the presence of albumen, sugar, leucine, and tyrosine in the urine. Dr. Graves thought that bilious stools were generally speaking dangerous.[1] This is probably because they are met with in the non-obstructive forms, and therefore belong to severer constitutional disease; but Dr. Graves thought also that they attended scirrhous or serious organic disease. Jaundice in the early months of pregnancy is often dangerous unless it can be traced to simple catarrhal conditions.

The prognosis of the obstructive forms must depend greatly upon the cause of the obstruction, cancerous being more dangerous than non-malignant growths. In all obstructive disease the possibility of ulceration and rupture of the gall-bladder, and its consequences, must not be overlooked. Deep color of surface and secretion, succeeded by paleness in obstructive disease, indicates deficient secretion of bile, probably owing to impaired cell-tissue, and is unfavorable.

In all forms of Jaundice associated with other diseases, the prognosis must depend upon the prognosis of the concurrent mischief. This must always be attended to in giving an opinion as to probable progress.

Treatment.—The forms of Jaundice which come on in the course of fevers and the various kinds of blood-poisoning, if unattended with congestion of the liver or symptoms of catarrh of the mucous membrane of the duodenum, require treatment adapted to the primary disease and to the vital state of the patient. His condition will probably require tonic treatment, with free ventilation and fresh air, and nourishment and stimulants carefully prescribed.

The malignant forms of Jaundice, though not hopeless, do not seem to admit of much treatment, especially after the nervous symptoms have set in. They demand eliminative measures, and those which have recovered have generally done so under the use of this class of medicines. Dr. Budd recommended a mixture with a combination of half to one drachm of sulphate of magnesia, fifteen grains of carbonate of magnesia, and half a drachm of spirits of ammonia, three times a day, "to keep up the action of the bowels, to neutralize any excess of acid in the system, and to keep up the action of the skin." To promote the elimination of urea and uric acid Dr. Murchison recommends warm baths, hot-air baths, diaphoretics, diuretics, and colchicum. Hemorrhage may be treated with gallic acid or tannin, &c., or other astringents; the typhoid state by the usual means.

Those who look upon these forms of Jaundice as due to suppression of bile will probably prescribe medicines to stimulate the hepatic secretion; but it must be remembered that in most of these cases secretion of bile is not arrested, though in many cases it seems diminished in common with other secretions, or with the destruction of the hepatic cell-growth and failure of its function. It is obvious that no stimulants to secretion will restore the cells to their integrity. The remedies most relied on to promote the secretion of bile are such as ipecacuanha, mercury, podophyllin, benzoic acid, mineral acids, &c. Of late years great doubts have been entertained as to the power of mercury over the hepatic secretion, and it does not appear to increase it in animals. It probably owes its chief use in Jaundice to its purgative action. Dr. Harley recommends benzoic acid. It should be given in the form of pill three times a day; the dose would be about fifteen grains in the day. Even if no good came of it, no great harm would be done by the administration of hepatic stimulants in Jaundice without obstruction.

Jaundice with congestion or with the temporary forms of obstruction due to catarrhal inflammations requires the local application of leeches, warm fomentations, or poultices over the epigastrium or hypochondrium, the free use of saline purgatives. It is usual in hepatic congestion to give blue pill at bed-time and a saline draught in the morning, the effect being not so much to excite biliary secretion and thus relieve portal congestion. The diet in this state should be simple, and unstimulating; hot irritating condiments or alcoholic stimuli would be likely to aggravate the hepatic congestion. The treatment of the catarrhal forms is conducted on the same principles. In the milder attacks it is desirable not to do too much. Sparing and simple farinaceous diet, or broths for the first days, diluent iced or effervescent drinks, saline draughts, with alkalies and aperients, perhaps a few leeches, warm fomentations, and rest in bed, are generally sufficient to relieve the complaint. The disease will not yield immediately under any treatment.

Jaundice with excess of bile, should be treated with purgatives to remove constipation or to relieve portal congestion. Active congestion of the liver requires leeches, fomentations, &c., to the hepatic

[1] Graves, Clinical Medicine, by Neligan, p. 423.

region. It sometimes happens that excess of secretion lasts for some time, and then probably depends upon debility. For this, tonics, iron, and quinine should be given. The quinine is especially useful if the complaint has a malarious origin. Good illustrations of the effect of tonic treatment in this state are given by Dr. Handfield Jones.[1]

JAUNDICE WITH CONTINUED OBSTRUCTION.—The object of treatment in this is—1. To remove the cause if possible. 2. To obviate the effects of the absence of bile upon the digestive process and nutrition by remedies and management of diet. 3. To combat such constitutional and local symptoms as may arise, and promote free elimination from the secreting organs. By judicious attention to the second and third objects, life may often be considerably prolonged, though little may be accomplished as regards the first. The cases in which we can hope to do much, or anything, towards the first indications are few. They are such as depend upon fecal accumulations, hydatids, abscesses, or other fluid collections pressing upon the duct. These last will probably be treated surgically on their own account rather than for the secondary disease. Free and repeated purgation by emollient enemata, to which ox-gall may be added, will clear out the bowels and remove the cause of pressure. The passage of gall-stones may be facilitated, and the great suffering caused by them relieved, by opiates given by the mouth or by hypodermic injection. Belladonna is sometimes useful, but less so than opium. Alkaline draughts and warm water soothe the sickness, and perhaps the pain. Warm baths and hot fomentations should be tried, and in severe cases the inhalation of chloroform. For the second object of treatment the bowels should be kept free from offensive matters, but not by irritating purgatives; acidity, flatulence, and fetid eructations by alkalies, vegetable charcoal, creosote, and the usual remedies. The gastric digestion may be assisted by pepsine given with the meals, muriatic acid and bitters. The food should be selected with care, and such as will be most readily digested by the stomach itself leaves less work for the after stages in the duodenum. A greater quantity of food will be required than in health, because much will be wasted. It should be mostly albuminous and such vegetable matter as does not add to the flatulence. Fatty and oily, and much starchy and pastry matters should be avoided. To supply the place of the bile inspissated ox-gall should be used. The dose should be six to ten grains with each chief meal, given about three hours after it, so as to reach the duodenum about the time that the chyme has passed the pylorus, and thus perform the duty of bile in the right time and place. Dr. Harley thinks that this object is less attained by inclosing the inspissated ox-gall in gelatine capsules, containing five grains each, to enable it to reach the duodenum unacted upon by the stomach.[1] Alcoholic stimulants should be avoided. Claret may be taken if it agrees with the patient; of course, in cases of debility, other wines may be given in moderate quantities. Diuretics and diaphoretics may be given if the kidneys or skin do not act freely. Dr. Murchison recommends the use of the warm bath and the avoidance of sudden chills. The scorbutic, hemorrhagic, and typhoid states must be met by the usual remedies; cerebral symptoms by purgation, revulsives, and diuretics—avoiding cantharides as Dr. Murchison judiciously observes; dysenteric stools by emollient injections or occasional aperients of rhubarb, fomentations, sedatives, and small anodyne enemata; inflammation about the gall-bladder or ducts, by leeches, fomentations, &c.; rupture of the gall-bladder by fomentations and the free use of opium. Careful nursing and cleanliness, and abundance of fresh air, are essentials; bad bed-sores are apt to form in the typhoid stages, especially when the urine passes involuntarily. It is scarcely necessary to notice that medicines which increase the secretion of the liver are injurious in obstructive jaundice.

In order to obviate the destructive effects of long-continued permanent obstruction upon the secreting tissue of the liver, Dr. Harley has advocated puncture of the distended gall-bladder and the establishment of a biliary fistula. The gall-bladder has often been punctured before for biliary distension when it has threatened to burst and permit of extravasation of its contents. It would not be difficult to reach the distended bladder from the surface. Of course, there would be risk of extravasation into the peritoneal cavity, a circumstance very likely to occur after puncture, as the retreating liver would withdraw the gall-bladder from the abdominal walls. Dr. Harley recommends the use of escharotics, to produce adhesions between the gall-bladder and the parietes of the abdomen previous to puncture, in the manner recommended by Dr. Graves for opening hepatic abscess. Some such steps would be necessary before attempting an operation. There would doubtless be danger in this operation, but in permanent non-malignant obstruction such an operation would probably preserve the secreting tissue of the liver, and

[1] Functional Nervous Disorders, pp. 514, 515.

[1] Op. cit. p. 129.

deserves mature consideration. If a biliary fistula were well established, it might become a question whether, in a case of impacted calculus, dilatation of the opening might not permit or facilitate the escape of a concretion or the extraction of small ones.

Itching of the surface is sometimes very troublesome. It may be relieved by warm baths, friction of the surface, potash or soda internally, and, in severe cases, by opiates.

The yellowness of the skin remains for some time after the cause of Jaundice is removed. Baths with carbonate of soda, benzoic acid, and aperients are supposed to be useful. Probably time and fresh air are the most efficient agents.

The treatment of convalescence must necessarily depend upon many conditions. Residence at the seaside or at Cheltenham, and the use of the Cheltenham waters are beneficial. It is not necessary, in cases of simple Jaundice, for patients resident in tropical regions to seek change of climate. This, however, should be resorted to if convalescence is prolonged, or if there be serious congestion of the liver, or enlargement, the result of malaria.

BILIARY CALCULI.—GALL-STONES.

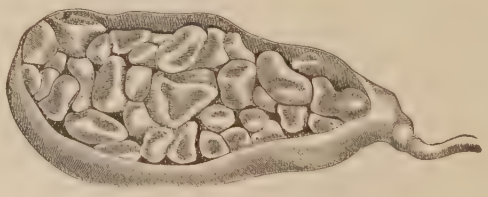
By Edward Goodeve, M.B.

Description.—Concretions originating in the gall-bladder, or biliary ducts, derived partly or entirely from the constituents of the bile. They are met with in all parts of the biliary passages.

These concretions vary in size, shape, color, specific gravity, structure, chemical composition, and in the number existing in the same individual.

The *number* may be one or many hundreds. There may be a simple concretion, or they may be, and generally are, numerous. The fewer the number, the larger they generally are. They are often found in large numbers in the bile ducts, in very rare instances distributed throughout the liver; in one case they were so numerous as to impede section of the liver with a knife. Though they may exist in any part of the bile containing apparatus, they are far more frequent in the gall-bladder than elsewhere, so that this receptacle may be considered as their principal seat.

[Fig. 60.



Calculi impacted in the gall-bladder.]

The *size* and *shape* depend much on the number; when numerous they are generally small. The larger concretions are generally found in the gall-bladder; a solitary oval one, moulded to the shape of the bladder, sometimes completely fills it. They have been found as large as a hen's egg. Meckel mentions one of five Paris inches in length by four in circumference.[1] Mr. Blackburn records one of $3\frac{3}{8}$ inches in length and $1\frac{1}{2}$ in. largest diameter. and weighing 1 oz. 6 drachms.[1] Concretions one or two inches long are not rare. When very numerous, the calculi are not larger than a hemp seed or millet seed; when smaller than this they are called biliary sand or gravel; the most common sizes are those compared to peas, or the kernel of hazel-nuts. When solitary, calculi are generally roundish or oval; when numerous, they are of roundish or squarish outline, with facets, or

[1] Frerichs' Clinical Treatise on Diseases of the Liver. New Sydenham Society's translation, vol. ii. p. 499.

[1] Lancet, December 12, 1868.

many sides, from attrition. They are sometimes found filling up the gall-bladder, and fitting accurately to each other by their sides. Occasionally, when two or three only exist, they may articulate, as it were, by their ends. In rare instances, the concretions have a leaflike appearance, with black glistening surfaces, and those found in smaller canals may have a coral, or branched-shape, like casts of their ducts.[1] The surface is generally smooth, especially when they are multiple, but they have sometimes a wrinkled appearance like peppercorns, or are tuberculated, or rough, like small blackberries. Good colored illustrations of Biliary Calculi are given in the second part of Frerichs' Atlas, and in the plates of Dr. Budd's Diseases of the Liver.

Biliary sand or gravel sometimes exists in considerable quantity. Dr. Thudichum found the biliary ducts of a man who died with gall-stones, full of brown sand-like matter. Dr. Handfield Jones relates a case of jaundice and death owing to obstruction caused by them.

The *consistence* may be firm or waxy, they may be cut with a knife without much difficulty, or easily crushed. They have frequently a soapy or greasy feel. They are often brittle, and can be broken down with slight force into sand or gravel. Dr. Thudichum thinks that the material binding the particles together is cholic or choloidic acid, or both;[2] it has also been supposed to be mucus.

The *color*, externally, may be white or whitish, brownish-yellow with greenish tinge, blackish, or mottled; some are very dark or black; the color depends on the chemical composition. They are generally opaque, but some are pellucid, or slightly translucent.

[Fig. 61.

Gall-stones.]

Structure.—Gall-stones are sometimes homogeneous, but are generally made up of different chemical compounds, arranged in layers, or mixed together; sometimes they have a radiated appearance. They are generally composed of a nucleus, body, and crust, the nucleus being surrounded by the body, to which succeeds a shell or crust, and these parts are often easily traceable, on section, by their color, in which there are sometimes great contrasts, but these distinct layers are not constant. The nucleus is generally dark, and may be of pulpy, hard, or friable consistence, the body lighter than the nucleus and the external layer lighter still; but this is not always the case, a dark deposit may succeed a light one. The nucleus is more or less round, and generally consists of a small quantity of biliary coloring matter; frequently of the small black shrivelled concretions of deposited bile pigment, which have passed from the smaller bile ducts to the gall-bladder, and served as a foundation. Dr. Thudichum has shown that in some cases the central or nuclear part contains casts of the bile ducts, and he has given several colored illustrations of these bodies.[1] Epithelium sometimes serves as a nucleus. The nucleus is generally small, the bulk of the calculus being made of the deposits around it. Two or three nuclei are sometimes found; in one instance as many as five existed. In these cases several small calculi or nuclei, being cemented together, have become the origin of a larger concretion. Though the nucleus is usually dark, it is sometimes white, as when it consists of cholesterine. In rare instances, it is some foreign body which has found its way into the ducts, as a fruit stone, a clot of blood, or an entozoon. A case is recorded in which it consisted of a globule of mercury,[2] and in another of a needle.

The body, sometimes called the striated part, is generally radiated, sometimes homogeneous looking, or in layers. It consists of cholesterine, more or less mixed with pigment.

The crust or cortical part consists of successive layers, and is found on calculi which have existed some time; occasionally there is scarcely any body, and the cortical layers surround the nucleus immediately. The crust is more developed in some parts than others; it may consist of cholesterine giving a white color to the calculus, or of pigment and lime, or of carbonate of lime. In some cases, from unevenness of deposit, the external layer may in one part consist of cholesterine or pigment compound, and in another of carbonate of lime, the latter being probably derived from the walls of the gall-bladder. It will be impossible to describe the varieties of appearance presented by the deposition and different parts of these layers.

The *specific gravity* of the concretions differs with the composition. With the

[1] Frerichs' Clinical Treatise on Diseases of the Liver. New Sydenham Society's translation, vol. ii. p. 501.

[2] Thudichum on Gall-stones, p. 166.

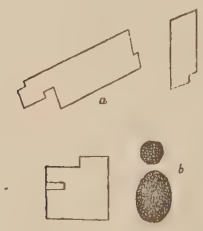
[1] Thudichum on Gall-stones, p. 60.

[2] Franconneau Dufresne, Précis des Maladies du Foi, &c. Paris, 1856.

exception of those of cholesterine, they are slightly heavier than, and sink in, water; when they swim it is owing to air contained within the interstices of the calculus, after their having been kept for some time in a dry place. The specific gravity varies from 0·800 to 1·50 or 1·60.

The chief *chemical constituents* of gall-stones are cholesterine, the coloring matters of the bile, biliary acids, fatty acids, carbonic or phosphoric acids, lime, soda, magnesia; with these may be mixed mucus and epithelium. Cholesterine and coloring matter are the most common elements. The difference in kind and proportion of the constituents accounts for the different physical conditions of the stones. Generally, but not without exception, the calculi found in the same subject are of similar composition. Chemical analysis is required to decide upon the minute composition of gall-stones, a full description of which is given in Dr. Thudichum's work. Their chemical nature, however, is roughly indicated by their physical conditions. The white or colorless, pearly, nearly transparent calculi, with crystalline fracture and radiated structure, consist of little else than pure cholesterine. They are generally covered with minute crystals of cholesterine, are soapy to the touch, of little weight, and are often large. Cholesterine, mixed with little or much bile pigment, and a little lime or magnesia constitutes the majority of calculi. When they contain a large percentage of cholesterine, they are of whitish color, of light specific gravity, and often have a lamellar arrangement. In others with a larger amount of pigment, the color is much deeper. This may be partly uniform, or may be distributed in layers which may

[Fig. 62.



Cholesterine tablets and glomeruli.]

be concentric with cholesterine, showing thus alternate layers of white and dark yellow pigment deposit. These are generally of medium size. The small, black, angular, irregular, tuberculated, brittle masses about the size of and somewhat resembling peppercorns, are composed of bile pigment and lime; the bile pigment is in a modified state, and called by Thudichum modified cholochrome. The resinous calculi of Dufresne are dark in color, easily crushed, with fracture like sealing-wax, forming a powder of yellowish-green color, like powdered aloes; they are very rare, and consist chiefly of cholic acid. Besides there are concretions made up chiefly of stearate and margarate of lime, which are of dirty-white color, and lamellar structure, somewhat like cholesterine calculi. The carbonate of lime species are of crystalline fracture, rough surface, with sharp angles, brown or brownish color, and heavy. They consist almost entirely of inorganic matters.

Biliary sand or gravel, according to Dufresne and Thudichum, consists of three kinds of ingredients, cholesterine, coloring matter, carbonaceous or black pigment matter. The cholesterine sand is yellowish from bile-staining, facets are often recognizable on them with a lens; pigment sand is in small grains mixed with a little cholesterine; and black sand resembles powdered coal or jet.

Dr. Thudichum has classified gall-stones according to their prevalent chemical composition as follows,—

1. Pellucid or pure Cholesterine Calculi.
2. Mixed Calculi, with prevalence of Cholesterine.
3. Calculi, with prevalence of Cholochrome.
4. Calculi with prevalence of modified Cholochrome.
5. Gall-stones, with prevalence of bile acids.
6. Gall-stones, with prevalence of fatty acids.
7. Gall-stones, with prevalence of Carbonate of Lime.[1]

Causes of Gall-Stones.—These are obscure, and are to be sought for in local and constitutional conditions. The local are such as lead to chemical changes of the bile within the gall-bladder or passage, allowing precipitation of its constituents. Any circumstance which causes an acid state of the bile, or interferes with the solubility of the coloring matter, leads to the formation of a precipitation or nucleus, round which other constituents of the bile may group themselves. The growth is favored by stagnation of the bile in the gall-bladder, and hence the reason, probably, why this receptacle contains more than other parts of the passages. In favor of the view of the precipitation being due to morbid states of the bile, owing to decomposition, it has been found that when bile is allowed to stand for a long time in a bottle, it becomes acid spontaneously, as Drs. Thudichum and Gorup-Besanez have shown, and de-

[1] Franconneau Dufresne, Précis des Maladies du Foi, &c. Paris, 1856, p. 107.

posits pigment previously dissolved, probably in the cholate of soda. It is likely that in unhealthy bile such a change may occur, lead to a deposit, and originate calculus.

Dr. Thudichum suggests that the decomposition may be due to a putrid ferment, absorbed by the intestine. Mucus from catarrhal states of gall-bladder or ducts has been supposed to favor the decomposition. When the commencement is made, if the nucleus is retained long enough in the passages, other matters group themselves around it, and growth ensues, even if the original morbid condition is absent. Carbonate of lime appears to be in most cases, at all events, furnished by the walls of the bladder or ducts. It is doubtful whether inspissation of bile can form a nucleus, or whether it is necessary that there should be any excess of the material forming the calculus in the bile.

The constitutional states which favor the formation of gall-stones appear to be such as relate to life, sex, habits, diathesis, &c.

Age.—They are much more frequent in middle-aged or elderly than young people. The great majority of cases occur above the twenty-fifth year. A few only are found below that age. Wolff mentions a case of a boy of ten years old, one of twenty, and of twenty-two years of age.[1] They have been found in new-born infants. Women are more liable than men—according to some statistics as three to two. Fat people, and those of indolent and sedentary habits, which favor the stagnation of bile in the passages, seem more liable than the active and spare, but these latter are not exempt, as most practitioners must have noticed, nor are phthisical people. There is no certain connection between diet and hereditary tendency and gall-stones nor any known diathesis predisposing to it.

The increase of cholesterine in the blood of old people has been considered as a predisposing cause, but gall-stones form before the period of life in which this change occurs. As cholesterine exists naturally in human bile, a supply of this element is always present, and no special blood-change is needed to furnish it. It cannot be said that any known constitutional state has any decided influence in the production of gall-stones. At present it seems more easy to attribute their origin to changes in the bile from some local cause, their subsequent form being determined by simple deposition, as in the case of a foreign body in the urinary bladder.

[1] Virchow's Archives, 20th vol. pt. i. p. 2. 1861.

Consequences and Effects of Gall-stones.—These are various and often dangerous. They may be arranged under the following heads:—

1. They may remain stationary in the ducts or gall-bladder, without causing much inconvenience.

2. They may pass from the branches of the ducts, or gall-bladder, by the common duct into the duodenum, causing in their passage slight or severe disturbance of the system.

3. They may be arrested in their passage, and act as plugs, completely or partly obstructing the channel in which they are stopped; sometimes causing obstructive jaundice, or even permanent closure of the duct.

4. They may become encysted, or, at any period of their existence, give rise to degeneration of neighboring tissues, inflammation, suppuration, softening, ulceration, pyæmia, or even rupture or perforation of the structures in which they lie, leading to extravasation of the contents, or giving rise to fistulous passages, by which the calculus may escape.

5. Arrived within the intestinal canal, they may be voided with the evacuations, and entirely got rid of, or they may be arrested in some part of the canal, causing obstruction or other mischief.

It may be well to consider these consequences *seriatim*.

1. In numerous instances gall-stones have been found in post-mortem examination, without any suspicion having been entertained of their existence. It is evident, therefore, that they may be latent. It is rare, however, that they do not cause some disturbance, though it may not have attracted notice.

2. Though a quiescent calculus in the ducts or gall-bladder may cause little inconvenience, it often gives a great deal of pain when it moves onwards. It is especially severe when it passes from the gall-bladder into the common duct. Concretions in the smaller branches of the ducts may move onwards without much disturbance, because the channels become wider as they progress. If small they may even pass through the mouth of the common duct, without severe symptoms. Biliary sand or gravel generally passes easily and unnoticed. The pain which attends the passage of calculi through the ducts is known as biliary colic, or as a fit of gall-stones.

3. Simple arrest of a calculus may interfere with the free course of the bile, and its effects vary with the place of detention. Arrested in the cystic duct, it will prevent the bile from passing in or out of the gall-bladder. If the stoppage is permanent, the bile in the receptacle will be absorbed, and replaced by mucous secre-

tion, by which the bladder may be distended, in some instances enormously dilated, and the walls become thin and transparent. When arrested in a small branch of the duct, the calculus may cut off the passage of bile, which accumulating, may press upon the secreting tissue behind it, and ultimately produce atrophy of the part involved. If the arrest be in a large branch or in the hepatic or common duct, obstructive jaundice will follow. The completeness of the jaundice will depend upon the efficiency of the plug; rounded and smooth concretions more completely fill up the passage, but angular stones often permit some bile to trickle past them, allowing feces to be more or less colored. The size of the calculus that can pass through the natural passage is larger than might be supposed. Rokitansky says that one the size of a hen's egg may do so, but there is little doubt that when not larger than an almond or walnut they have escaped through the duodenal orifice of the duct. This has sometimes been found, in cases in which stones have passed, large enough to admit easily the forefinger. It is probable that the very large calculi which have passed by stool have found access to the intestine through fistulous openings.

The passage of one calculus smooths the way for those that may follow. These, if not much larger than the pioneer stone, generally pass with much less distress. The disturbance caused by a gall-stone is not always proportioned to its size. Angular concretions cause more pain than smooth ones of similar size. When the gall-stones are numerous, several may pass in a single attack, and as many as a hundred have passed by stool after a fit of biliary colic.[1] Gall-stones in the gall-bladder or cystic duct do not cut off the passage of bile, and thus do not cause jaundice.

4. Gall-stones may at any period of their existence cause serious or dangerous symptoms. They may excite inflammation of the part in which they lie. This, in its most mild form, may end in the stone becoming encysted, and thus cut off from contact with bile and growth by deposition. In other instances suppuration or abscess may occur. If the cystic duct is stopped up when suppuration occurs within it, the gall-bladder may become greatly enlarged by purulent distension. Repeated attacks of inflammation of the gall-bladder may cause it to thicken, and, if there be no contained secretion, to shrink or shrivel up. If there be calculi within it, they may be tightly embraced by the contraction. When inflammation occurs round calculi within the ducts, abscesses may form in the neighboring parts of the liver, and the calculus may pass from the duct into the substance of the liver, and lie imbedded in the abscess. Other results of inflammation are softening or ulceration of the tissues round the stone, which may allow of rupture of the parts and escape of the calculus from its bed into neighboring parts. In these cases rupture may take place under slight movements, or in coughing and vomiting. If this accident happens to the gall-bladder, or hepatic or cystic ducts, extravasation may take place into the abdomina cavity, giving rise to perforative peritonitis. Fortunately, in the more common process by which a calculus escapes from its bed, adhesions are formed between the containing part and some neighboring viscus or tissue. If this occurs at some part of the stomach or intestines, softening and absorption, slight suppuration or destruction of the intervening tissues takes place gradually, and an opening is made by which the stone, and fluid matters surrounding it, bile, pus, or blood, pass into the tube, and a fistulous opening results. The duodenum is the most frequent seat of this process, but it may take place in the stomach, colon, or small intestine. It has occurred in the portal vein and in the ureters. Sometimes the gall-bladder is glued to the abdominal wall, an abscess may form and lead to discharge of the stone through an external opening formed naturally, or by incision. Sometimes the opening or pointing of the abscess is at a considerable distance from the region of the gall-bladder. In rare instances the stone has passed into the thorax. In all cases of fistula bile may continue to flow through it, but this will depend upon the connection with the biliary passages being open or not. Occlusion of the cystic duct will prevent bile passing through the gall-bladder, and the same will happen for other parts if the communication with the bile ducts is cut off. When the communication is open, the bile will continue to pass by the new channel for an indefinite time, but if the natural passage is pervious, the cholic fistula may gradually close. In some instances calculi will continue to pass by the fistula for some time.

[A case has been recorded by Dr. Anger,[1] of Menilmontant, France, occurring in a woman aged 63 years, in which, after frequent attacks of colic, numerous fistulous openings were spontaneously made in the abdominal walls. By dilating one of these openings with tents of laminaria, Dr. Anger was able to extract about a hundred gall-stones from the enlarged ductus choledochus and gall-bladder. The fistulæ then gradually healed up, and the

[1] Franconneau Dufresne, Précis des Maladies du Foi, &c. p. 334

[1] La France Médicale, April 16, 1879.]

patient obtained better health than for many years before.—H.]

Pyæmia and secondary abscess in the liver are among the most formidable occurrences that attend gall-stones. The walls of the gall-bladder may undergo fatty degeneration in cases of calculus lodged within it, and rupture and extravasation may occur without previous marked symptoms.

5. When the gall-stone has reached the intestine, it is generally evacuated by stool. If it passes into the stomach, it may be vomited. Dr. Murchison doubts whether a large calculus which has entered below the pylorus can pass upwards.[1]

Gall-stones are not always got rid of so easily. It is supposed that they may grow larger within the bowel, if detained within it, as sometimes happens. They have sometimes caused obstruction. Dr. Murchison mentions a case in which the calculus fitted the bowel like a cork, and produced fatal obstruction. Dr. H. Jeaffreson relates one in which perforation of the ileum just above the ileo-cæcal valve was caused after a long interval by a stone passed into the duodenum through an opening in the gall-bladder.[2]

Gall-stones may be entangled in the pouches and angles of the intestines, and have been known to be arrested in the vermiform appendix of the cæcum. The consequences may be inflammation, gangrene, perforation, peritonitis; in short, all the evils consequent on permanent obstruction of the intestine.

Symptomatology.—It will be sufficient to mention the ordinary or special symptoms of gall-stones; the accidental ones, such as jaundice, inflammation, suppuration, pyæmia, &c., need not be detailed here.

Calculi when in the gall-ducts, and even in the gall-bladder, unless of unusual size, as already shown, may excite no disturbance, or only uneasy sensations, occasional shivering, with or without heat and sweating, which may be mistaken for ague, and be sometimes manifested periodically in women. Small calculi may pass into the intestine without marked symptoms. Biliary sand or gravel may cause only indefinite symptoms of weight and uneasiness, and often pass away from the liver unheeded. The symptoms produced by the passage of larger calculi are often of the most painful and agonizing kind. Those due to the passage of a calculus from the gall-bladder through the cystic duct are typical of the attack of biliary colic, and will serve for illustration.

In these fits, perhaps, after experiencing uneasy sensations for an hour or two, or perhaps quite suddenly, the patient is seized with violent pain in the epigastrium or lower part of the chest, coming on in paroxysms, abating in intensity, and renewed with increased violence. The pain generally comes on two or three hours after a meal, about the time that the food begins to pass into the duodenum, and the bile to flow from the gall-bladder, and may appear to originate in some exertion, or jerk, or coughing, or some such movement. Vomiting comes on, first emptying the stomach of any contents, and afterwards continuing and bringing up very acid clear fluid: it is sometimes very distressing. In milder cases there may be only retching and nausea. The attacks frequently begin with shivering, which may be followed by heat and sweating; shivering often lasts for some time. The most remarkable and characteristic symptom is the pain. In some cases it is most agonizing.

The patient describes it as burning, cutting, twisting; he is generally very restless, or rolls in agony on the floor, or presses his hands on the epigastrium, or seeks all sorts of positions, to obtain momentary ease. The seat of the pain is referred to the hypochondrium, the epigastrium, and lower part of the chest, sometimes radiating to the clavicles, and with sense of constriction over both sides. Although there is difficulty in defining the sort of pain in many cases, and especially at the onset of the paroxysms, it is sometimes pretty clearly referred to the right hypochondrium and epigastrium. In some instances convulsive movements of the muscles of the right side of the abdomen have come on; these have extended to the whole of the right side, and have been known to end in general epileptic convulsions and delirium. The sufferer is bathed in cold sweat, the pulse becomes feeble or thready, and fatal syncope has occurred. Generally the pulse is not excited, and retardation of the heart has been noticed, and looked upon as diagnostic; but though as a rule slow, it is not invariably so. There is often much flatulence and generally constipation. The duration of the fits of colic may be a few hours, but they have been prolonged for two or three days, though this is rare. They may return every day. Wolff has known them to do so daily with regularity. The interval between the fits may be days, weeks, or months. The fits may extend over a considerable time before the calculi are got rid of; in Wolff's cases, the longest period was about eighteen months; the majority of the cases occupied from two to twelve months. It may happen that a solitary calculus may be expelled and the disease come to an end; but there is more frequently a succession of attacks, lasting

[1] Lectures on Diseases of the Liver, p. 509.
[2] British Medical Journal, May 30, 1868.

over a considerable period. As has been mentioned, the fit of pain may come to an end after more or less suffering. The cessation of the pain may be due to the stone having slipped back into the gall-bladder, to its having passed into the common duct, or to the exhaustion of expulsive efforts. When the calculus falls back into the gall-bladder, the pain may cease for an indefinite time: if merely arrested in the ducts, the pain will probably be renewed shortly. In the latter case the stone moves on towards the duodenal orifice, the narrowness of which opposes a fresh obstacle, bringing back fresh spasm and pain. After a renewal of the struggle the calculus slips into the duodenum with great if not perfect relief, the transition from agony to ease being sometimes very rapid. A sense of soreness, however, sometimes remains for a few days. A succession of calculi passing through the cystic duct or orifice of the duct may keep up a renewal of the paroxysms, but generally the passage of the first is by far the most painful, and as the duct is dilated numerous calculi may subsequently escape with little or no annoyance. Still the pain is very severe and distressing, and may be prolonged with variable intervals for months, being most distressing to the patient and annoying to the practitioner. In the mean time the sufferer's nutrition is pretty well maintained if there is a fair interval between the attacks.

During the paroxysms there is sometimes pain on pressure over the gall-bladder and hypochondrium; in some of these instances the pain is more fancied than real, as the patient often presses the epigastrium himself. After the fit is over, there is often much soreness and tenderness lasting for days.

Biliary sand sometimes causes fits of colic equally as severe as those of calculi. It must not be supposed that all fits of biliary colic are of the severe character just described. The pain is sometimes less marked, and the whole fit less exhausting. The degree of pain will vary somewhat with the size and shape of the stone and the susceptibility of the individual. There is also much difference in the degree of the reflex disturbances.

Jaundice is not a necessary consequence of gall-stones even when they pass into the bowel. Impaction in the cystic duct does not cause it, and it will not occur if the calculus is not detained beyond a couple of days in the common duct, but when there is delay beyond this, jaundice and white feces will ensue. The icterus will be slight, coming on towards the end of the attack and quickly passing off, or becoming permanent if the impaction continues. Jaundice is often considered a necessary part of biliary colic, but observations show that it is absent in a large proportion of cases. Twenty-five of Wolff's forty-five cases passed through the whole train of symptoms without it, the concretions being found in the evacuations.

It is desirable to watch the feces after these attacks, and satisfactory to know that the stones have passed. The feces should be well diluted with water, thrown on a sieve with small meshes, by which the calculi will be arrested. Simple dilution and pouring off the fluid a few times will leave a sediment in the vessel in which they may be found. As they occasionally float, the surface should be examined also. It is not enough to watch for a day or two after the attacks. The presence of gall-stones in the bowels may cause no symptoms. They may be evacuated without any disturbance, or they may cause a little griping and colic, or tenesmus in passing the anus. The symptoms peculiar to irritation or obstruction of the bowels need not be detailed here.

Diagnosis.—Biliary Calculi frequently give rise to no symptoms, so that their existence is unsuspected. This is especially the case in the smaller duct. They may be suspected when there is dull pain in the hepatic region, and occasional fits of shivering, with heat and sweating, resembling ague. In the gall-bladder they may also be latent, but are more likely to cause uneasiness. The pain is sometimes dull; sometimes pretty sharp, and referred to the seat of the gall-bladder, or edge of the liver. The diagnosis of gall-stones is more difficult in countries in which hepatic disorders are prevalent, but the absence of enlargement of the liver or spleen, or anæmia, or history of inflammation of the capsule, will assist the diagnosis. The dull pain in the right hypochondrium, caused by the distension of the colon, will be removed by purgative medicines or enemata. It is well to remember that fits resembling ague, occurring in persons of fair health, may depend upon gall-stones in the ducts. [Severe itching of the skin, all over the body, often accompanies such attacks.—H.] In cases of pain in the right hypochondrium, the region of the gall-bladder should always be explored. Fulness of the gall-bladder may sometimes be felt, and a peculiar crackling sensation, indicative of calculi, perceived by the tips of the fingers. A large stone may sometimes be made out pretty accurately. They may, if numerous, sometimes be recognized by the stethoscope, if pressure is used at the same time. In fat people the state of the gall-bladder is not likely to be ascertained.

Fits of biliary colic are generally not

difficult of diagnosis. The sudden accession of pain, aggravated in paroxysms, and attended with shivering fits two or three hours after meals, the constrictive nature of the pain, and its being generally referred to the right side of the abdomen, are very characteristic. Jaundice coming on makes the diagnosis more certain, and the finding of the stone confirms it. In a large number of cases, however, jaundice is absent. The absence of feverishness and quick pulse, the avoidance of movement on the part of the patient, and the catching pain in respiration, distinguish acute inflammation of the capsule, or surface of the liver, from biliary colic. Biliary colic may be mistaken for painful affections of the stomach, intestinal and renal colic, and aneurisms of the abdominal aorta and hepatic arteries.

It may be distinguished from pain of undigested food in the stomach unable to pass the pylorus by the manifest relief afforded by the vomiting. From simple neuralgia of the stomach by the seat of pain and uneasiness about the gall-bladder, and soreness on pressure there during the intervals of the attacks. The painful symptoms of organic disease of the stomach are generally distinctive enough. Intestinal colic is traceable to indigestible food or lead poisoning, and is felt lower down in the abdomen. Renal colic is accompanied with irritation of the urinary organs, blood disks or decided blood in the urine, and drawing up of the testicle.

Aneurisms of the abdominal aorta sometimes give rise to intense paroxysms of pain which may be referred to the right side.[1] Frerichs relates cases of aneurism of the hepatic artery, which were mistaken for gall-stones, and which even caused jaundice. Aneurisms may generally be detected by tremor, pulsation, and murmurs. In one of the cases mentioned by Frerichs, however, the aneurism of the hepatic artery was not larger than a pigeon's egg, and hardly diagnosable. Fortunately, aneurisms of the hepatic artery are very rare. In some persons, owing to the wide radiation of pain, and the difficulty they have of localizing their sensations, very little assistance in the diagnosis is derived from inquiry as to the seat of the pain, and if jaundice is absent it is difficult to decide upon the existence of biliary colic. It is well to remember that a great number of the painful and spasmodic affections of the upper part of the abdomen, occurring in elderly persons not otherwise unhealthy, depend upon gall-stones. [Dr. Putnam-Jacobi,[2] on examining *post-mortem* the body of a patient who, after suffering with many attacks of hepatic colic, died of another disease, found several calculi in the gall-bladder, one as large as a walnut; yet the ductus choledochus was not enlarged. The inference was, that, as the gall-stone was too large to enter the duct, the pain suffered must have been due to *spasmodic contraction* of the gall-bladder alone; a true *cholecystic colic*.—H.]

If the calculus is large with a rough surface, we may hope that it is solitary. If, on the other hand, the calculi are smooth and faceted, they are numerous.

We should infer that a calculus was arrested in the cystic duct if the pain ceased, leaving perhaps uneasiness about the gall-bladder, and if after a little time it began to distend without jaundice or enlargement of the liver. If, on the other hand, jaundice and enlargement of the gall-bladder and liver come on, we should infer impaction in the common duct.

Prognosis.—This must be guarded. A large number of cases recover completely after more or less suffering. Still the accidents which have been described as occasionally attending gall-stones, from their beginning until their final expulsion from the body, show that they involve considerable risk. These cases may run on for years, and ultimately become dangerous.

Treatment.—This should aim at relieving the effects of Biliary Calculi, and preventing their formation.

The violent pain of biliary colic calls urgently for relief. This must be attempted by anodynes, of which opium in some shape or other is amongst the most efficacious. Half a grain of morphia freshly made up into a pill, or in solution, may be given and repeated every two hours for two or three times if the pain does not abate. The effects of opium are most certainly and speedily produced by the hypodermic injection of morphia: one-sixth of a grain may be injected beneath the skin, and repeated every two or three hours till one grain has been administered, but of course the repetition must be guided by circumstances and not resorted to until the effects of the previous dose are passing off. If the pain is greatly soothed it will be sufficient. If the opiate treatment does not relieve the pain, chloroform inhalations may be resorted to; the patient may be kept under its influence for some time. It is not necessary to produce deep coma throughout the paroxysm. Chloroform may also be given internally instead of by inhalation. Belladonna is supposed to relax the spasm: it may be given in half-grain doses of the extract, or in ten minims of the tincture every three hours, and withdrawn if its physiological effects

[1] Stokes, Diseases of Heart and Aorta, p. 612.

[2] N. Y. Med. Record, Feb. 28, 1880, p. 238.]

begin to snow themselves. Belladonna, however, seems more useful in the milder forms of the disease, in which the passage of the calculus is prolonged; given then in half-grain doses, two or three times a day, it may facilitate its passage. Benefit is derived from the use of the warm bath. If there be much depression, however, instead of this, warm fomentations may be applied assiduously to the right side and epigastrium. The acid vomiting and spasm are often greatly relieved, as shown by Dr. Prout,[1] by the use of frequent draughts of warm water, containing one or two drachms of carbonate of soda to the pint. The first portions are generally rejected, but the fluid is afterwards retained, and the pain and retching abate. Laudanum may be combined with it. Emetics should not be given; they are likely to add to the risk without helping the stone to pass through the ducts. After the stone has passed the common duct, it is better to leave its expulsion to nature than to give purgatives; the less the bowel is irritated, the better the prospect of the stone passing. If there be decided tenderness in the hypochondrium, leeches afford relief.

Medicines have been prescribed with the view of dissolving the calculi in the gall-bladder. Although at one time they were in repute, it is not easy to see how some of them, such as ether, chloroform, and turpentine, can act; indeed it is probable that the only benefit they afford is by quieting spasms. [Dr. T. H. Buckler[2] asserts that there is nothing more certain in medicine than that chloroform will dissolve calculi in the gall-bladder. He gives not more than 60 drops (gradually increased from smaller doses) thrice daily, continued, if need be, for several weeks together. He also advises the succinate of iron, to aid in decomposing the gall-stones by giving out oxygen freely.—H.]

Alkaline medicines have been recommended with better reason, but it is doubtful whether they have a solvent effect upon the stones. If the bile would be rendered more alkaline, there might be less chance of deposition, and possibly some diminution of the calculi takes place, but we are in the dark as to the effects of such remedies. The alkaline medicines recommended are, carbonate of soda and phosphate of potash. Their use should be maintained for some time. The mineral waters of Carlsbad, Vichy, Ems, and Marienbad have great repute in cases of biliary calculi. Frerichs says that they have certainly proved efficacious remedies against gall-stones. Dufresne recommends Vichy, and for delicate persons, Ems. There is no good evidence, however, that these waters have any solvent effect upon the stones, and though patients are relieved there by passing the stones, it is not possible to say that they might not get rid of them elsewhere. Frerichs thinks that the quantity of water taken produces a more copious flow of bile, and hence the calculi are forced onwards more easily. As most of these waters can now be had imported, it would be well to try them in England. The patient's diet should be regulated. He should avoid fat substances and malt liquor. He should be enjoined to take moderate exercise, and to be in the open air as much as possible. The visits to the watering-places above mentioned have the advantage of combining fresh air and pleasant scenery, all of which improve the general health, and it may be presumed that the better this is, the more chance there is of the bile being kept in a normal state.

[The operation of *cholecystotomy* (puncturing or incising the gall-bladder) has been introduced within a few years, for the relief of distension of the gall-bladder from mechanical obstruction. The signs relied upon as indicating this are: persistent jaundice, clay-colored stools, nausea or vomiting, itching all over the body, and enlargement of the gall-bladder ascertained by palpation.

Petit[1] proposed this operation in 1733. Le Dran,[2] Morgagni,[3] Good,[4] Handfield Jones,[5] Maunder, Hughlings Jackson, and Thudichum[6] have referred to the operation as justifiable and practicable. The first actual performance of it (except one mentioned by Good without particulars) was that of Dr. Bartholow,[7] in 1876. The second operation was that of George Brown, M.R.C.S.,[8] in 1878, for supposed abscess. His incision did not reach the gall-bladder; but shortly afterwards a spontaneous opening in it gave exit to the accumulated bile through the wound, and the patient recovered. The third case was that of Dr. J. Marion Sims.[9] Dr. W. W. Keen[10] performed the operation in

[1] Nature and Treatment of Stomach and Renal Disease, 4th edit. p. 257.

[2] Boston Medical and Surgical Journal, Oct. 23, 1879, p. 583.]

[1] Mém. de l'Acad. Royale de Chirurg., 1743, i. 255.]

[2] Traité des Opér. de Chirur. 42, p. 253.]

[3] De Sedibus et Causis Morborum, 1761, Lib. iii. Lit. xxxvi. art. 52.]

[4] Study of Medicine, Amer. ed. 1855, p. 215.]

[5] Med. Times and Gazette, March 9, 1878. Dr. H. Jones's proposal was, to open the abdomen and push the gall-stone into the intestine without puncturing the gall-bladder.]

[6] Brit. Med. Journal, Nov. 19, 1859, p. 935.]

[7] Cincinnati Clinic, April 7–21, 1877.]

[8] Brit. Med. Journal, Dec. 21, 1878.]

[9] Brit. Med. Journal, June 8, 1878.]

[10] Amer. Journal of Med. Sciences, Jan.

1878; drawing off a quantity of fluid by means of the aspirator, but not ascertaining the cause of the obstruction. The patients died in the cases operated upon by Drs. Bartholow, Sims, and Keen. Bryant[1] and Lawson Tait[2] have both performed cholecystotomy successfully. Where the diagnosis approaches certainty, it appears to be an entirely legitimate operation.—H.]

SUPPURATIVE INFLAMMATION OF THE LIVER.

By W. C. Maclean, M.D.

Definition.—Diffuse or circumscribed inflammation of the parenchyma of the gland, resulting in resolution or in suppuration, the abscesses in the latter case being sometimes single, sometimes multiple. A disease for the most part confined to hot and malarious countries, rarely seen before the age of 20 or after 45, often associated with dysentery, which it seriously complicates. Occurring sometimes in an insidious form, unmarked by very distinctive symptoms or much constitutional disturbance; or, of a more acute type, with local and sympathetic pain, pyrexia, and other symptoms depending on the situation and extent of the inflammation. The duration of the disease cannot be defined, varying as it does from a few days, when it may be presumed resolution has taken place, to 120 or more, after suppuration.

Synonyms.—Hepatitis Acuta; Hepatite; Inflammation du foie, *Fr.;* Leberentzündung, *Germ.*

In treating of the disease which is to form the subject of this article, I prefer the term "suppurative inflammation of the liver" to that of *hepatitis;* for inflammation of the capsule, *perihepatitis*, and inflammation of the parenchyma, are often both included under the latter term; and these diseases, although alike in some of their symptoms, differ in their site, termination, and consequences. The term Hepatitis Chronica is used in a still more extended sense, for, particularly in military practice, it is frequently applied to diseases which have no etiological relation to one another, and in which inflammatory action has in fact played no part from first to last. This confusion results, in part, from the necessity of conforming to the official classification of diseases in use in the British and Indian armies.

Etiology.—Suppurative inflammation of the liver is a rare disease in temperate climates. When pus is found in the liver in temperate countries, unless the case has been imported from a hot climate, the abscess can generally be traced either to inflammation following a direct injury, such as a blow in the right hypochondrium, to the existence of septic matter in some distant part of the body, or to inflammation of branches of the portal system after operations about the rectum. In those rare instances in which foreign bodies become lodged in the liver, abscesses may form around them, and the same result follows the intrusion of lumbrici from the intestine along the biliary ducts into the substance of the gland. Only one example of hepatic abscess following a blow has come under my observation. A soldier of intemperate habits, while intoxicated, was run away with by a horse and dashed with violence against a gate-post; an enormous abscess of the liver followed, which proved fatal. Instances of pus deposits in the liver following suppuration in distant parts of the body are related by many surgeons; and Budd and Frerichs, from the writings of Dance, Cruveilhier, and Dr. Jackson of Calcutta, give examples of hepatic abscesses following phlebitis of the portal vein after cauterization of a cancer of the rectum, operations for fistula in ano, the extirpation of hemorrhoids, and violence in reducing prolapsus of the rectum. This is anatomically intelligible, when it is remembered that the pelvic veins of the hemorrhoidal plexus communicate with the portal system through the inferior mesenteric vein.

In the Pathological Museum of the Army Medical Department at Netley there is a preparation of the liver of a man who died of phthisis, showing a

and April, 1879. The above references are mostly taken from Dr. Keen's papers.]

[1 Med. Times and Gazette, 1878, ii. p. 682; and Med. Press and Circular, May 14, 1879.]

[2 Lancet, Nov. 15, 1879.]

cavity, the size of a walnut, in the lower part of the right lobe, in which a needle two and a half inches long, of a dark color, was found. The patient had swallowed the needle two years before. The cavity of the abscess communicated with the duodenum immediately below the pyloric orifice of the stomach; through this opening the pus had drained away unobserved. The existence of the abscess does not appear to have been suspected during life.

In the same collection there is a specimen showing the liver perforated in every direction by lumbrici, around which small abscesses had formed. The gall-bladder and biliary ducts are also distended with these filthy intruders, and some were found in the stomach and duodenum, in the nares also, and even in the frontal sinuses, probably sent there in the act of vomiting. The specimen was taken from the body of a Maltese boy, two years of age, who died of dysentery; but whether or not symptoms of hepatic mischief were noted during life is not recorded in the brief history of the case. Suppurative inflammation of the liver is a disease of hot and malarious countries, but, for reasons not yet well known, not equally prevalent in all. Thus it is common and fatal in India, while in the West Indies this disease is rare, and the mortality from it trifling. In both countries the temperature is high, and as regards the use and abuse of alcoholic liquors, the habits of Englishmen are much the same in both. Dr. Parkes thinks that the greater use of highly spiced food and unskilled cooking among soldiers in India may to some extent explain the difference. But I suspect our countrymen in the West Indies are nearly as much given to stimulate their languid appetites by hot peppers as Anglo-Indians. It is more probable that the insular climate exercises a salutary influence. There is no lack of malaria in the West Indies, but it is less generally diffused — more local than in India; and, although the temperature is high, the air is tempered and purified by the regular action of the sea-breeze in a manner quite unknown in India, save over a limited area of that vast continent contiguous to the sea. In the West Indies, Europeans can, and do, expose themselves to the sun with comparative impunity. English soldiers undergoing penal discipline, laboring in the quarries and on the roads during the hottest part of the day, maintain good health; but on the continent of India, if similarly employed, they would certainly suffer severely from sunstroke, hepatic and other affections of an acute type.

It is impossible to overlook the influence of continued high temperature in causing suppurative inflammation of the liver, although some esteemed authors have made light of it. A most insidious and fatal form of the disease prevails on the continent of India in those parts of the country where great heat and concentrated malaria act together. Morehead —while he admits that heat is under certain conditions a direct exciting cause of inflammation of the liver, and explains in this way, "its occurrence in the hot months of the year in plethoric Europeans lately arrived in India, with excreting functions deranged by free living"—regards "external cold, acting on systems depraved by the cachexia induced by residence in the tropics, as the most frequent cause of hepatic inflammation." Sir Ranald Martin also insists much on this view, having often seen acute inflammation of the liver follow exposure to the influence of a cold north wind on people issuing from heated ball-rooms in Calcutta.

Intemperance in drinking exerts a powerful influence in predisposing to this disease. It is well known that spirit-drinking is an exciting cause of inflammation of the connective tissue of the gland, yet at Netley, where we see all the invalids of the British army from India, cirrhosis is by no means a very common disease. I believe the explanation to be that the intemperate there are, most of them, cut off by more acute diseases, such as delirium tremens, acute inflammation of the liver, and dysentery, before there is time for the development of so chronic an affection as cirrhosis.

According to Waring's invaluable statistical inquiry into the pathology of abscess of the liver, out of forty cases in which the habits of the sufferers were noted, 67·5 per cent. were intemperate.

Indolence and excess in eating, combined with heat and malaria, are probably the most active causes of the disease amongst men and women in the higher classes not given to intemperance in drinking.

The frequent association of hepatic abscess with dysentery has been already briefly adverted to in the article "Dysentery" in another part of this volume. The opinion that suppuration in the liver is most frequently caused by ulceration of the intestines, the stomach, the gall-bladder, or gall-ducts, is one that, although held to some extent by other authors, has found its ablest advocate in Dr. Budd. The theory is, that the liver becomes involved by some contamination of the portal blood. Dr. Budd holds that small and scattered abscesses result from contamination of the portal blood, either by pus, formed by suppurative inflammation of one of the small intestinal veins, or by matter of other kind resulting from softening of the tissues; and when the

inflammation has been diffuse, ending in a large collection of pus, he attributes the result to the absorption of the fetid gaseous and liquid contents of the large intestine in dysentery, conveyed immediately to the liver.

I have already stated (article "Dysentery," *ante*, p. 213) that in dysentery of long standing it is a rare thing to see a sound liver; a careful examination of the post-mortem registers at Netley has satisfied me that this observation has even a wider application than I was aware of. Dr. Budd's exclusive theory has not been generally accepted by physicians who have investigated it with care; in India, in particular, it has few supporters. I can only very briefly indicate the facts that militate against it. While the frequent coexistence of the two diseases is admitted, if Dr. Budd's explanation were true, abscess of the liver ought to be a much more common disease than it is. Thus, as has been noticed by Waring and many other writers, it does not follow ulceration of the glandular structures in the intestine in enteric fever and other affections.

Although dysentery is occasionally seen in temperate climates with ulceration, softening, and even gangrene of the mucous tissues, hepatic abscess is extremely rare. Thus, in Dr. Baly's oft-quoted cases in the Millbank Penitentiary, amounting to "many hundreds," hepatic abscess was not found in a single case.

In the Pathological Museum at Netley there are forty-eight specimens of abscesses of the liver. In thirty-four the abscess was uncomplicated with any intestinal lesion; in nine there was a dysenteric history, but no record of any intestinal lesion; in five, hepatic abscess and intestinal lesions coexisted. In three of the above it is specially noted that the dysenteric symptoms followed the formation of abscess.

In fifty of Morehead's fatal cases of dysentery there was no abscess of the liver, and in twenty-one of his fatal cases of abscess there was no ulceration of the intestines. Dr. Parkes examined twenty-three fatal cases of dysentery in India and Burmah, and found consecutive hepatic abscess in five, or in 21·74 per cent. Mr. Waring collected from six different regiments serving in the Madras Presidency 260 fatal cases of acute dysentery; there were sixty-eight complicated with abscess, or 26·15 per cent. The same author gives 300 fatal cases of abscess of the liver from Indian records; in only 27 per cent. was the hepatitis preceded by dysentery. In 204 of the cases where the condition of the large intestine was noted after death, there were no appearances of dysentery in fifty-one. Out of twenty-five fatal cases of dysentery in the post-mortem register at Netley, mostly from India, abscess of the liver was found in only three.

It would be easy to multiply evidence of the same kind; enough has been given to disprove the exclusive pyemic theory. But I am far from denying that it accounts in a reasonable way for an uncertain but probably considerable number of cases of suppurative hepatitis resulting in multiple abscesses.

Morbid Anatomy.—It is not often that an opportunity is afforded of examining the liver before the formation of pus has been completed. In a few cases of multiple abscesses I have seen the process in its different stages going on in different parts of the same liver. Allowance being made for peculiarities in the structure of the affected organ, there is, as Morehead has observed, no difference between the formation of an abscess in the liver and the same process elsewhere.

There is first a stage of hyperæmia, of turgescence, circumscribed or diffuse, as the case may be; when cut into, the part bleeds freely, and often presents a granular appearance. This granular surface is quite visible in some of our Netley specimens that have been many years in spirits.

Bounding this red and softened portion there is a buff-colored ring of uncertain magnitude. Sometimes this pale yellow color is widely diffused, as in a case of mine examined at Netley in July, 1867—in which a superficial abscess on the convex part of the right lobe had discharged into the right lung, the buff color pervading the whole of the affected lobe. At a later stage lymph is effused into the congested portion, which now assumes a pale color; on section, yellowish points containing pus will be seen thickly distributed over the section. These pus spots, according to Frerichs, "first form in the centre of the lobules, the margins still remaining firm." The pus points rapidly coalesce, forming an abscess, large or small, according to the extent of the inflammation and the amount of effused lymph.

The condition of the hepatic tissue surrounding the abscess varies. Sometimes it is seen to be of a dark color, and hardened; in others this dark color gradually fades into the pale yellow described above; and again, the boundary between the two is sharply traced.[1]

[1] In the British Medical Journal of June 22d, 1867, there is the notice of a paper read before the Berlin Medical Society by Dr. Cohnheim, detailing the results of his observations on the formation of pus as a product of inflammatory action. In this paper Dr.

The condition of the gall-bladder is, as might be expected, variable, depending on the duration of the case, the amount of hepatic tissue implicated, and other causes affecting the quality of the bile. It has never happened to me to see its coats affected with inflammation in connection with hepatic abscess; but I have noticed a great variety of conditions in the bile found in it after death. In some it is black, thick, and tenacious; in others grass-green and viscid; and in a few cases thin, almost watery, and of a brownish-red appearance. Where inflammation is found it has probably been excited by the vitiated nature of the biliary secretion.

Kind, Position, and Number of Abscesses.—The abscesses resulting from the suppurative process may be single or multiple, superficial or deep-seated, circumscribed or diffuse, encysted, or limited merely by an ill-defined and incomplete lymphy deposit.

Some abscesses are circumscribed by a boundary of effused lymph, more or less complete; others are quite undefined, with their margins ragged and shreddy. A few are inclosed in cysts of varying thickness. Only seven out of forty-eight cases in the Netley Museum have distinct well-defined cysts of varying thickness. In two specimens the investing membrane has attained to a "cartilaginous thickness," and in another an inverted cyst is shown nearly as thick as ordinary wash-leather. These membranous investments are evidently formed by the consolidation and organization of the circumscribed effused lymph, assuming the form of condensed connective tissue. Some cysts are perfectly smooth within, while others are more or less granular. Abscesses of old standing have their internal surfaces smooth; those of recent formation are more or less ragged, shreds of lymph and softened hepatic tissue hanging from the walls of the cavity. Abscesses may form in any part of the gland. In Mr. Waring's collected cases, the right lobe alone was affected in 163, or 67·355 per cent.; the left lobe in sixteen, or 6·611 per cent.; and both lobes in thirty-five, or 14·462 per cent. In the Netley preparations the abscess is situated on the convex and upper and outer part of the right lobe in thirty-six cases; on its concave surface in three; while the left lobe is affected in only seven cases; in one the abscess is intermediate; both lobes were affected in five of the cases.

Abscesses vary infinitely in number. Dr. Parkes mentions a case in which ninety were found, and in Mr. Waring's collected cases the number varied from one to thirty-six. In the Netley collection thirty-seven are single and eleven multiple. In three the abscesses are said to have been "numerous;" but as only portions of the liver are preserved, it is impossible to say how many there were; the rest vary from one to six, and in one case the organ is converted into the sac of a huge abscess, which contained seventeen pints of pus, and two of a thin serous fluid.

Quantity and Quality of Pus.—The quantity of pus varies from an ounce or two to the enormous quantity recorded above, viz., seventeen pints. In another of the Netley cases seven and a-half were found, the abscess involving the whole of the right lobe. In Mr. Waring's collected cases the quantity varied from four ounces to a gallon, which large amount was found in two cases.

Pus has been observed in hepatic abscesses to present every variety of color, consistence, and odor. According to my experience, as a rule, it is "laudable," that is, of the consistence, color, and slight odor of a so-called healthy abscess. I have seen examples presenting the red and pinky color described by various authors, and others in which the pus has a marbled appearance, given to it by streaks of a pinkish color, composed of blood intimately incorporated with pus. Much depends upon the circumstances of each particular case, whether or not air, for example, has had free access to the suppurating cavity as after surgical operations for the relief of abscesses, in which case, the pus will generally soon lose its "laudable" character, and become more or less offensive. Mr. Waring has noted it as "thick," "creamy," "white," "greenish," "seropurulent," "brownish" or "reddish," "dark yellow," "very offensive matter mixed with sloughy shreds," and so on. Examination with the microscope will often reveal portions of hepatic tissue, and

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Cohnheim announces, as the result of his observations and experiments, that pus-corpuscles not only closely resemble white-blood cells, as has long been known, but are *identical*. "He has," says the able correspondent of the Journal, "proved that pus-corpuscles are actually white cells which have emigrated from the blood-stream." If this view of pyogenesis should be established, the old theory "which refers the origin of pus-corpuscles to the proliferation of cells or germinal matter in connective tissue, has received its death-blow." It appears to me also that it will throw a new light on the formation of purulent collections in the liver in that obscure class of cases where such abscesses are found without any of the recognized signs of inflammatory action in men and women suffering from malarial cachexia, in whose blood white cells abnormally abound. If the new view is accepted by pathologists generally, it ought to give "a death-blow" to something more than a theory of pus formation; it seems to explain also why blood-letting fails so often in this class of cases to prevent it.

where the abscess has found its route of discharge through the right lung, traces of lung tissue may also sometimes be found.

Modes of Discharge.—Abscesses of the liver may remain intact until death, or may find issue (*a*) externally through the abdominal walls, (*b*) through the diaphragm into the lung or pleura, (*c*) into the pericardium, (*d*) into the stomach, (*e*) into the intestines (duodenum or colon), (*f*) into the abdominal cavity, (*i*) into a pouch of peritoneum, (*j*) into the hepatic vein.

Of the Netley Museum cases, twenty-nine remained intact at death, some tending towards the outer walls, others to the diaphragm; two were discharged by operation, six opened into the right lung, three into the cavity of the chest, three into the pericardium, two into the stomach, one into the duodenum, one into the colon, and one into a pouch of peritoneum. In Mr. Waring's oft-quoted three hundred cases,[1] the abscesses terminated in the following manner:—

	No.	Per cent.
Remained intact	169	56·335
Evacuated by operation, a solitary abscess being present	29	
" there being numerous abscesses, one opened, and the others remaining intact	18	16·000
One abscess opened by operation, another subsequently bursting into the abnormal cavity	1	
Opened spontaneously into the thoracic cavity	14	4.666
" " into the right lung	28	9·333
" " into the abdominal cavity	15	5·000
" " into the colon or large intestines	7	2·333
" " into the stomach	1	
" " into the hepatic vein, leading to the vena cava	2	
" " into the hepatic vein, at its junction with the vena cava, and another communicating with the cellular tissue around the right kidney	1	
Communicated with the hepatic ducts	1	
" with the right kidney	2	
" with the gall-bladder	1	
" with an abscess in the iliac region	1	6·333
Opened spontaneously through the ribs in the back	1	
One abscess had opened into the colon, and another had passed off by the hepatic ducts into the duodenum	1	
One abscess had opened into the stomach, a second into the duodenum, and a third had been evacuated by operation	1	
One abscess had opened into the abdominal cavity, and a second into the lungs	1	
Terminated in erysipelas of the lower extremities, simulating phlegmasia dolens, the abscess opening into the lungs	1	
Doubtful	5	
	300	100·000

Do abscesses of the liver ever undergo absorption?

Nothing is more common than to observe puckered depressed cicatrices on the surface of the gland. The Netley collection contains many such specimens. In the early years of my Indian service these were invariably regarded as evidence that a superficial abscess had formed and been absorbed in that spot. That some of these admit of such an explanation can hardly be doubted, but more recent and accurate observation has demonstrated the frequent association of these cicatrix-like depressions with the syphilitic dyscrasia; and where they contain the gummatose nodules, the "grayish-yellow fibroid nodules" of Frerichs, with palpable evidence, in other organs, of constitutional syphilis, no doubt can be entertained as to their true nature.

Dr. Morehead gives three cases in which the process of absorption had certainly taken place, and one in which recovery in this way was probable. In the cases where absorption had evidently occurred, a "putty-like substance" alone remained in the sac, identical, I presume, with the "cheesy matter" described as found under like circumstances by Frerichs and other observers.

Clinical History and Symptoms.—There is no disease so difficult to describe as suppuration of the liver, and, paradoxical as the saying may be, I suspect this difficulty is experienced most by those who have had most experience in dealing

[1] Waring's Inquiry into the Statistics and Pathology of some points connected with Abscess in the Liver.

with it. The task assigned to me in this article is to describe suppurative inflammation of the liver, but, as I have already said, there is a disease so closely resembling it in many of its symptoms, and, consequently, so often confounded with it, that I must briefly advert to it here. This is inflammation of the investing capsule of the liver, the *perihepatitis* of Frerichs and other writers.

Morehead appears to think that this disease is not common in India. It is always with diffidence that I venture to differ from this accurate clinical observer of tropical disease. But I have long held a different opinion, and often given expression to it in my published writings, and in my lectures in the Army Medical School. The diagnosis is far more important than is at first sight apparent. A great deal of the support that is still given to blood-letting in the treatment of suppurative inflammation of the liver is based on the apparent success that often follows the large abstraction of blood, in preventing, as is imagined, the formation of abscess, whereas, in a not inconsiderable number of cases, the measure has been directed against a disease which has no such termination. Thus, a very recent writer, after acknowledging that he recognized the case to be one of capsular inflammation, informs his readers that he bled his patient to the enormous extent of 166 ounces, besides purging him severely by a combination of active cathartics, and, because no abscess followed, draws the conclusion that the bleeding prevented suppuration.

Perihepatitis is met with under two forms, first as an idiopathic disease; and secondly, consecutive to abscess of the parenchyma. Omitting those cases in which it occurs as a part of general peritonitis from any cause, and those in which, according to Frerichs, "the capsule becomes inflamed in right pleurisy," the inflammation spreading to the serous covering of the diaphragm and of the liver, the capsule of the gland may inflame just as the pleura does after chills, when a person has been overheated. The symptoms resemble those of pleurisy much more than those of inflammation of the parenchyma. There is pain which is sharper and more acute than in true suppurative inflammation. This pain is sensibly aggravated on pressure, or a full inspiration, or after any movement. It is described often by the common expression "stitch in the side." The liver is not congested, and the urine does not differ from its normal appearance; with the above symptoms there is more or less febrile excitement. The result is exudation of lymph between the gland and its capsule, strong adhesions, sometimes extending to neighboring organs, and occasionally the presence of a thin layer of purulent matter. In the case of an invalid from India, who died lately at Netley from aneurism of the arch of the aorta, the liver was so closely embraced by its adhering capsule as to cause atrophy of the whole organ. This man had a history of "hepatitis," and had doubtless been treated for inflammation of the parenchyma.

The second form of perihepatitis is that in which it occurs when an abscess of the parenchyma involves the capsule as it makes its way to the surface. The symptoms will then depend upon the position of the abscess. As I shall presently show, it often happens that active treatment for the prevention of suppuration is commenced at the setting in of these symptoms, which indicate, not the commencement, but the last step of the process. I know no point in the whole clinical history of hepatic inflammation of so much importance as the one just described.

The following are examples: W. M. A——, medical officer of the Madras army, of a delicate constitution, had suffered severely from dysentery, and occasionally passed some muco-purulent matter at stool. This gentleman paid me a visit, and spent some hours with me, in the Medical School at the residency of Hyderabad in the Deccan. I observed that he looked ill when he arrived; he confessed that for many days he had been ailing without any very marked symptoms beyond loss of appetite, a feeling of general malaise, and a disinclination for any active physical or mental exertion. While engaged in examining some of the pupils, he suddenly experienced a distinct rigor, with a feeling of approaching syncope, followed by a copious perspiration. After he had rested a little in the recumbent position, I drove him to my house. In the evening he rallied sufficiently to return to his own home, four or five miles distant. Next day he resumed his duty, experiencing now and then transient chills followed by slight flushes of heat. In a few days from the date of his visit to me, while playing whist with some friends, he was suddenly seized with acute stabbing pain in the right hypochondrium, above the false ribs, with sharp fever, followed by cough, and sympathetic pain in the shoulder—in a word, the symptoms usually said to denote "acute hepatitis." Had I seen him then, I certainly should have dissuaded him from following the treatment his own judgment suggested, viz., active blood-letting, general and local, with purgatives, followed by calomel. I saw him thirty-six hours after the setting in of the above symptoms, free from pain, but much prostrated, and expectorating purulent matter, from an abscess of the liver, through the right lung. The issue of the case was fatal; and on examination I

found an abscess on the convex surface of the liver, communicating with the lung, which was much disorganized, and two other abscesses deep in the right lobe, and extensive ulceration of the great intestine. I never entertained a doubt as to the true nature of this case. The active treatment began when it could avail nothing. The acute symptoms indicated a curative process, namely, adhesive inflammation of the capsule to the diaphragm, preparatory to the advance of an abscess, long antecedently formed, and its evacuation by the lungs. It is impossible to conceive that the mischief revealed after death dated only from the setting in of these symptoms. I always regarded this as an unequivocal case of hepatic abscess, consecutive on ulceration of the intestines.

Here is another case, with a more fortunate issue: Lieut. ——, H. M. —— regiment, arrived at Madras, from Secunderabad in the Deccan, in charge of a detachment of troops. This officer, twenty-four years of age, had been two years in India, had lived foolishly, drinking to excess, keeping late hours, and frequently exposing himself in the snipe-field, a hot sun overhead, his feet being immersed in water much colder than the surrounding air. For days before I saw him he had been ailing, eating nothing, or next to nothing, but drinking much. His complexion was dark and muddy, his eyes were congested, his breath heavy and alcoholic, he had no fever, no heat of skin, and his pulse did not exceed eighty. He had little to say in the way of complaint, except that he was "ill," and unfit for anything but to recline on a sofa. I examined his liver with care. It was enlarged, without doubt; he had a sense of fulness, but allowed me to take any liberties I pleased in the way of palpation and percussion. His urine was high-colored, loaded with lithates, and so turbid that I could not see the bottom of the vessel. I felt convinced that I had to do with deep-seated mischief in this young man's liver; but, even had I been disposed to put active antiphlogistic treatment in force, there was ample reason in his habits to forbid it: a moderate bleeding would have been followed by delirium tremens.

Short of such measures I did what the case admitted of, and gave orders to be called as soon as acute symptoms set in, which I confidently looked for. Within fifty hours I was called to him. After a sharp rigor, he had stabbing pain in his right side with fever, cough, a "to-and-fro" sound at the base of the right lung, soon followed by purulent expectoration. Dr. Paul, of the General Hospital, saw the case with me; we were quite at one about the treatment. We well knew that antiphlogistics could avail us nothing here, that the mischief had been done before the patient came under medical observation. His strength was therefore sustained by suitable means, pain was allayed by fomentations and opiates, the mineral acids with quinine were given, and in a short time we had the satisfaction of sending this young man to England quite convalescent. Had he been seen for the first time on the setting in of the acute symptoms, and without a knowledge of his antecedents, and treated according to routine, I think the issue would have been different. Blood-letting could not have prevented the formation of an abscess (that was already there), although it would certainly have weakened the patient; and if mercury had been given, and it had acted, as it is supposed to act, viz., by preventing the effusion of lymph, or causing its absorption after effusion, the result would have been equally unfortunate, for adhesion of the opposing surfaces would have been prevented or destroyed, the conservative operations of nature would have been interrupted, and escape of the abscess into the abdomen must have ended the case. Having thus premised, I proceed to consider the

SYMPTOMS OF SUPPURATIVE INFLAMMATION.—These are said to be a sense of fulness and weight in the right hypochondrium, pain, inability to lie on the right side, fever, disturbance of the digestive organs, cough, and sympathetic pain in the shoulder, and, according to some authors, jaundice. In the two cases just given, and I could give many such, it will be seen that most serious and destructive mischief may be going on, and yet the symptoms may be such as to excite little alarm either in the patient or his attendant, unless he be a wary and experienced practitioner. Looking at the above symptoms in their order, it will be found that enlargement of the liver, with the sensations to which it gives rise, will generally be present if a considerable part of the gland is implicated in the morbid process, but every tropical physician will call to mind numerous examples in his experience of abscesses as large as an orange having been found without any enlargement likely to attract attention.

Pain.—The liver is not a sensitive organ, and the most serious mischief may be going on deep in the substance of the parenchyma, and yet no pain may be complained of. On the other hand, pain may be acutely felt, and yet, as I have explained, the parenchyma may not be affected at all. This symptom is always influenced by the depth at which the inflammation is going on, being usually well marked where the inflammation is superficial, less so, or absent, where it is deep. It was present in 85 per cent. of Rouis's cases (Frerichs). When pain

and enlargement coexist, the case is more serious.

Fever.—In latent abscess there may be no disturbance of the circulation, until the abscess approaches the surface. It is astonishing how little the pulse is affected, often not exceeding 80, when a large abscess may be in process of formation deep in the gland. When, however, the capsule is affected, there is an immediate rise in the frequency and sharpness of the pulse, and in all cases of superficial inflammation it is affected from the first. Careful observations with the thermometer made by me in the clinical wards at Netley, have, in every instance of suppuration of the liver recently under observation, shown a rise in temperature of from one to three degrees Fahr.

Disturbance of the Digestive Organs.—Loss of appetite is an occasional, but by no means invariable, attendant on the disease; as might be expected, it is common in the intemperate, but often there is little disturbance of the digestive system. I can confirm the fact noted by Frerichs, that when suppuration commences, "the tongue becomes covered with a gray or yellowish coat." On the other hand, violent gastric symptoms may be excited when the stomach or duodenum are implicated, as an abscess tends to discharge into one or other of the cavities.

Respiration is disturbed, or not, according to the situation of the inflammatory action. When an abscess is making its way through the diaphragm, a short dry cough is then developed, often preceded, and for a short time attended, by a friction murmur at the base of the lung, which, however, does not last long. Sympathetic pain in the shoulder is much insisted on by most writers, and is said to be most common when the inflammation is on the convex portion of the liver. Annesley and Parkes say this is a symptom of uncertain value, and it is often present in chronic cases where there has been no suppurative inflammation.

The urine gives most valuable information, and should be narrowly examined. Dr. Parkes says, "that in the exquisite forms of hepatitis, as witnessed in hot climates, the urine is most highly febrile, and that the pigment is greatly increased. The few observations which have been made, imperfect as they are, show that there must have been an increase in the urea. When large abscesses have formed in the liver, however, and the functions of great part of the hepatic tissues are abolished, the urea is certainly sometimes deficient. The urine is then copious, pale, non-sedimentous, and non-albuminous." There is a field here for fresh researches, to which the attention of tropical physicians is earnestly invited.

[Dr. Hammond,[1] several years ago, ascertained that, in some cases, cerebral hyperæmia, with depression of spirits, insomnia, and gastric disorder, are associated with hepatic abscess, without distinctive local signs of it. On aspirating the liver, in such instances, the withdrawal of a quantity of pus has been followed by recovery. Dr. J. M. Sims[2] confirms this observation by cases in his own practice.

Dr. Hammond avers that hepatic abscesses are probably much more common than is generally supposed; and that, when believed to exist, an early opening is very important. Citing Dr. Davis, Dr. Jimney of Mexico (who has punctured the liver very frequently without any bad result), and Dr. Tansky of New York, in favor of operating by aspiration through one of the intercostal spaces, Dr. Hammond's preference is for the same region. He asserts that this operation is free from danger; so that even if no abscess be found, no harm will follow. Within two years, according to Dr. Sims, Dr. Hammond has aspirated the liver twenty-six times; in fifteen cases evacuating abscesses, with curative effect; in eleven, the operation was fruitless, but was attended by no ill effects. His punctures were made in the right lobe of the liver, between the eighth and ninth, or the ninth and tenth ribs. All but two of the patients so treated were residents of malarious localities.—H.]

Jaundice, although often given by systematic authors as a symptom of inflammation, is of little or no value for diagnostic purposes. Excepting to a slight degree in a few exceptional cases, I have never seen it. In Morehead's clinical cases it was extremely rare, but it seems to be rather more common in Algeria than in India (Haspel).

It will be seen from the above, that the symptoms of suppurative inflammation of the liver cannot be said to be very distinctive, yet, I venture to say, that a wary physician will not often be deceived. In the first place, practitioners in regions where this disease may be looked for, should always examine the condition of this great gland, even where there may not be much to call attention to it; if this be done, although little value can be attached to any one symptom, it is hardly possible by a careful attention to the patient's past habits and history, to his general condition, and to the result of a careful examination of the organ with all the aid to be derived from percussion and palpation and the use of the thermometer, to miss coming to a conclusion on which to base rational treatment.

[1 St. Louis Clinical Record, June, 1878]

[2 The Medical Gazette, Jan. 31, 1880, p. 74.]

Remembering also how frequently abscess of the liver is found in dysentery, the physician will, in treating that disease, have a watchful eye on the condition of this gland, both as to function and physical state; and should dysentery or obstinate diarrhœa follow hepatic symptoms, however obscure, and resist rational treatment, no prudent physician will fail to suspect hepatic disease. To sum up. In young sthenic subjects, who have not been long in the tropics, who have been living freely, exposing themselves to the sun by day and to chills at night, we may expect to see many of the above symptoms well marked. Again, in hot low-lying malarial localities, and particularly in men or women whose constitutions have been impaired by long residence in a hot climate, the symptoms will be more "silent" and insidious, and in all, the position of the affected part, as regards nearness to the surface or the reverse, the extent of the tissue implicated, and the contiguity of neighboring organs, will exercise a marked influence on the symptoms.

Signs of Suppuration.—How can we tell that suppuration has taken place?—The signs are local and constitutional. Where an abscess is situated on the outer aspect of the liver, fulness will be perceptible, and unless the pus be deep-seated, fluctuation will be detected by careful and delicate manipulation. These signs absent, the sudden setting in of sharp pain, aggravated by pressure or movement with a dry cough, and it may be a to-and-fro sound at the base of the lung, will at once raise the suspicion of abscess on the convex portion of the right lobe, "pointing" towards the chest. Deep-seated pain, less acute than the above, and attended with vomiting, points to the possibility of an abscess pressing for discharge into the stomach or duodenum, and irritating diarrhœa often precedes its discharge into the colon. There is a therapeutic sign of much value in dysenteric cases, it is insisted on by Morehead, viz., great intolerance of ipecacuanha. I have verified this important clinical fact on many occasions. Chills followed by hectic fever and exhausting sweats are signs of much value, but are often wanting. How is it that sometimes an abscess no bigger than a small orange, deep in the substance of the liver, may set up irritation enough to extinguish life, while, in other cases, abscesses twice or three times the size may exist for a long time, and cause little or no constitutional disturbance? Setting aside cases where the presence or absence of dysentery or extreme malarial or other cachexiæ may be the cause, the explanation is the presence or absence of a stout cyst. There is hardly a day of my life that I have not occasion to point out to the gentlemen candidates studying at Netley, not only the absence in some cases of chronic phthisis of constitutional irritation, where there is evidence of a tubercular deposit having taken place into the apex of one or both lungs, but also the wonderful comparative restoration to health, as evidenced by increased appetite and weight, cessation of cough, and so on; the explanation being a certified condition of the tubercular deposit, or its being cut off by a plastic partition, in either case ceasing to be a source of constitutional irritation. In like manner, where hepatic abscesses are stoutly encysted they may remain for months, perhaps for years, latent, producing little or no constitutional disturbance. In the Pathological Museum at Netley there are two preparations which will illustrate this observation. A sergeant, invalided from India for chronic hepatitis, presented himself at Fort Pitt. He had to all appearance recovered so completely on his voyage from India, that he was sent to the Dépôt for duty. Weeks afterwards, while straining at stool, "something gave way," and an hepatic abscess burst into the pericardium. In this case the cyst was of great thickness, and even of cartilaginous hardness.

In another case the patient, a native of Bombay, had worked on a plantation at Mauritius; he walked seven or eight miles in search of a fresh engagement, his health being apparently good. "Suddenly he complained of a pain at the pit of the stomach," and died in a few hours: an abscess of the liver burst in the pericardium; the abscess was lined with "a firm cartilaginous membrane." Here were two men who for months, perhaps for years, were able to go about, one of them to labor on a sugar plantation, yet both had abscesses in their livers; the only reasonable explanation of the absence of constitutional irritation being the firm barrier afforded by the investing cysts.

Prognosis.—Abscess of the liver is at best a dangerous disease, and under all circumstances demands a cautious prognosis. When it occurs consecutive to dysentery it is a formidable complication, and the prognosis is unfavorable.

An important element in the prognosis is the point of discharge. Abscesses bursting into the pericardium or peritoneum are always fatal, and that quickly. As a rule, the issue is seldom fortunate when the discharge is into the cavity of the pleura, or where the abscess points externally through an intercostal space. It is much more favorable when it points at the ensiform cartilage. In my experience the largest number of recoveries follow discharge through the lung, and next to that into the intestine. When air obtain-

free access to the cavity of an hepatic abscess, a favorable result seldom follows; and, whatever be the position of the abscess, the occurrence of much hectic, extreme emaciation, or diarrhœa, is of evil omen. The fact of the abscess being multiple or single must exert a powerful influence on the issue of the case; but it is seldom possible to do more than guess at the condition of the gland in this respect. Where, however, after the evacuation of an abscess (*e. g.*, through the right lung or the intestine), a patient does not improve, but continues to suffer from hectic and to emaciate, it is nearly certain that other abscesses exist and the prognosis must consequently be unfavorable.

Diagnosis. — The diagnosis between suppurative inflammation and perihepatitis has already been given. It is hardly possible to mistake a hydatid cyst for an abscess in the liver, if we attend to the previous history of the case, the absence of constitutional symptoms, the slow development of the tumor, its painlessness, and its smooth and globular shape. If suppuration has occurred, the diagnosis may not be so easy; even then the past history of the case, if carefully investigated, will lead to a right diagnosis, and, suppuration once established, the principles of management are much the same in both. If the question of abscess or no abscess in a case of dysentery is presented for solution, no physical signs of its existence being present, we may strongly suspect the occurrence of suppuration, when the signs of constitutional irritation are more marked than the severity of the primary disease explains, when nutrition fails, when the patient emaciates and grows hectic, even though there may be no hepatic tenderness or sympathetic pain in the shoulder, or any visible enlargement and fluctuation. [Exploratory operations, with the needle-trocar and canula, are now considered justifiable and often useful, when reasonable evidence of suppuration of the liver exists.—H.]

Treatment. — Before entering on a course of treatment, more particularly if active treatment be contemplated, it is above all things necessary to look narrowly into the patient's history, and all the particulars of the case, lest we fall into the serious error, already so often mentioned in this article, of mistaking the end for the beginning of the case, and directing treatment to prevent what has already occurred.

In a so-called inflammatory disease, the first remedial measure to be discussed is, of course, blood-letting. It is not necessary to waste words in condemning spoliative treatment in the class of cases occurring in low-lying, hot, and malarious localities, in the persons of those whose constitutions have been impaired by long residence in such places. If anything was wanting to complete the evidence of the utter unsuitableness of this treatment in such cases, the researches of Dr. Cohnheim, on the identity of the white blood-cells with pus corpuscles, already referred to, appear to have furnished it.

The question of the necessity, or otherwise, of bleeding is more likely to arise, when the symptoms of "acute hepatitis" occur in young men with constitutions but little impaired by residence in the tropics. In such, more particularly where the inflamed part of the liver is near the surface, the symptoms are sure to be much more marked and acute than in other forms of suppuration of the gland. The propriety of bleeding in such cases can be supported by a cloud of witnesses, many of them men of great weight and reputation as tropical physicians. But, as in other diseases, so in this, the necessity of the measure is called in question. It was my fortune, early in my career, to serve under one who believed in the efficacy of this measure, and, so believing, used it with conscientious perseverance and without hesitation or misgiving. I narrowly watched the results, and of this I am sure, I saw more cases of suppuration of the liver under this gentleman than I have ever seen since. I was never satisfied that it answered the end in view, viz., the prevention of suppuration, in a single instance; I have seen it relieve pain, abate fever, and at once reduce the force and frequency of the pulse. On the other hand, the signs of suppuration often followed so quickly as to suggest one of two conclusions, either that pus had formed before the bleedings were practised, or that its formation had been hastened by the proceeding. Where no such untoward occurrence followed, the effect was often to induce, unmistakably, prostration, anæmia, a long stay in hospital, and protracted convalescence. I have long abandoned the proceeding: in a few exceptional cases I have applied a few leeches to the side or to verge of the anus, but for more than twelve years before ending my Indian career I never once used the lancet.

Mercury.—Faith in calomel may be said at one time to have attained in India to the dignity of a dogma. It was supposed to exercise a controlling power over hepatic inflammation, preventing suppuration, either by arresting the effusion of lymph, or promoting its absorption after effusion. I have had large opportunities of seeing this remedy tried by men who were, in their time, deemed to be exceptionally skilful in its use. I was never satisfied that any useful result followed its

exhibition, other than could be explained by its purgative effects. I have seen it fail so often to arrest suppuration, that I utterly disbelieve in any such power. I have again and again seen suppuration of the liver occur when the patient was actually salivated; going, as it usually did, hand in hand with bleeding, it powerfully aided the malarial cachexy in blanching the patient, depraving the blood, and protracting the period of convalescence. Fourteen years ago I published a paper in the Indian "Annals of Medicine" to the above effect, and the result of my subsequent experience and observation has satisfied me more and more of the correctness of the views then given. In Mr. Waring's short but pregnant chapter on Treatment, appended to his "Inquiry," he gives ample evidence that at best it is "of doubtful utility," and that "its free exhibition is undoubtedly no preventive of hepatic abscess."

The high authority of Morehead can be quoted to the same effect, and Deputy-Inspector General Massy, formerly of the 2d Dragoon Guards, in an admirable paper on Hepatic Disease, published in the "Statistical, Sanitary, and Medical Report of the Army, for 1863," vol. v., has added his evidence to that of other recent observers against its use, on the ground that it "deteriorates the health, not unfrequently permanently." Before this physician ever set foot in India, he tells us that, while serving in Chatham, where he saw the invalids from India, he was often led to meditate over them, "uncertain whether mercury or disease of the liver had done most to deprave their constitutions." Year by year, I rejoice to say, the evidence of excessive mercurialization, among invalids from India, is becoming more rare.

Bleeding and the administration of mercury being thus objectionable, what remains? I answer, Ipecacuanha. For years past, in my lectures at Netley, I have urged the free use of this invaluable remedy not only in dysentery, but in suppurative inflammation of the liver. I give it in the same large and efficient doses as in dysentery—from 20 to 25 grains, and even more—and, so far as my experience extends, I am of opinion that it is nearly as efficacious in this disease as in tropical dysentery, the *modus operandi* being the same in both. I am happy to be able to add the valuable evidence of Dr. Massy to the same effect. Dr. Massy was led to use it in acute hepatitis from observing its effects on the liver when he gave it in acute dysentery complicated with congestion of the gland. In Dr. Massy's opinion it "quieted and equalized the circulation," and it certainly "caused nausea, profuse diaphoresis, and frequently large bilious motions." Dr. Massy aided the above effects by the use of leeches—I am far from saying that leeches are never required, but I am persuaded their use ought to be restricted to decidedly acute cases, in the persons of patients with unimpaired constitutions. Sir Ranald Martin has some excellent observations directed against indiscriminate leeching, and points to the enormous quantity of blood lost by their too free and frequent application.

The mode of giving the remedy is the same as in dysentery (*ante*, pp. 228 *et seq.*), the doses being repeated at intervals of five, six, or eight hours, according to the severity of the case. The side should be freely stuped and fomented, and if the ipecacuanha fails to produce free evacuations, aperient medicine should be given; but, remembering how close is the relation between dysentery and suppuration of the liver, care should be taken in the selection of the purgative. I have, in the article "Dysentery" (*ante*, pp. 213 *et seq.*), referred to the fact that Indian observers have noted, since ipecacuanha has come into general use in the treatment of dysentery, that abscess of the liver has been less frequent in their experience. Dr. Massy, in his paper already referred to, gives the following additional testimony to the efficacy of the treatment of hepatic inflammation by ipecacuanha. "My friend Dr. Laing, of the 23d Royal Welsh Fusiliers, informs me that he uses no other medicine in this disease, and that his practice is remarkably successful, far more so than when he was in the habit of employing mercury, which drug he has latterly altogether discarded." Closely allied to the above method is that recommended by Cutcliffe, Civil Surgeon of Meerut, published in the Indian *Lancet*, of February 15, 1860, and quoted by Dr. Massy. It consists in the administration of tartar-emetic in combination with nitrate of potass, two grains of the former to two drachms of the latter. This is divided into eight powders, one being given every half hour until pain is relieved, aided, in severe cases, by leeching and fomentations. Dr. Massy, from a trial of this method extending over a year, speaks very favorably of it. I have often used tartar-emetic in acute cases in strong young men, in minute doses quickly repeated, sometimes aiding its effects by small doses of tincture of aconite,[1] cautiously given; but the combination with nitre seems worthy of an extended trial in the class of cases above described, in which alone I should conceive it to be

[1] This, in all acute inflammations, is a remedy of much value. It may be given in doses of one drop every ten minutes, until six or eight drops have been given; continuing the remedy in the same doses every hour, *closely* watching its effect on the circulation.

applicable. Antimonial medicines, if used with the requisite precautions, unlike mercury, leave no sting behind them. If the above means be carefully used, and used early, the symptoms usually described as those of chronic hepatitis will seldom follow; if any dull undefined uneasiness remains in the side, it will often be dissipated by a blister, the use of the nitro-muriatic acid, and a little quinine. Even should the above treatment fail and suppuration ensue, the patient will be in a much better condition to bear the trying process and its consequences, with his powers unimpaired by depletion and the depraving action of mercury on his blood.

An abscess having formed, is it to be allowed to take its natural course, or is the aid of the surgeon to be called in to evacuate it by puncture? This is a most momentous question for the patient. Some practitioners are so much impressed with the necessity of early evacuation of abscesses of the liver, that they advocate a diligent search for the purulent collection, by what is called "exploration," as soon as they are satisfied, by the presence of certain constitutional signs, that suppuration has been established. I am opposed to this practice both on theoretical and practical grounds, and I may add that it has never been sanctioned by physicians of authority and experience in India. Morehead reprobates it in unequivocal terms. I think it contrary to sound surgical principles, and, as I have elsewhere explained (vide *Lancet*, vol. xxi. 1865, and "Army Statistical, Sanitary, and Medical Reports," vol. vii.), an interference with one of the most conservative operations of the system. If it be true, as I believe it is, that the most favorable route an abscess of the liver can take is through the right lung, and the least favorable — the one giving the smallest number of recoveries—is through the abdominal walls, it appears to me unjustifiable to expose the patient by a surgical operation to the risk of admitting air with its mischievous properties into the cavity of an abscess tending to a comparatively safe point of discharge. As far as I am able to judge, the advocates of puncture draw their support of their favorite practice from a small number of successful cases. The question is simplified a good deal when the abscess is visibly tending to the surface, and must ultimately be discharged through the abdominal walls. Is Nature in such a case to be allowed to operate in her own way; or is the surgeon to anticipate her proceedings? Where the abscess is large, where it is obviously causing much constitutional irritation and such symptoms as hectic, distressing cough, vomiting, or diarrhœa, it is impossible to wait, and the patient will usually be clamorous for operation. Nothing, as has been well shown by Dr. Budd, and more particularly by Dr. Lowe of the Madras Army (*Madras Quarterly Journal*, vol. vi.), a physician of much experience in dealing with such cases, can be more different from one another than the method of the surgeon on the one hand, and that of Nature on the other. The surgeon discharges the whole contents of the abscess at once, air takes the place of pus, and however great may be the relief, and it is often very great, from the operation, the issue is usually disastrous. Decomposition of the discharges from the cavity sets in, unhealthy extension of the suppurative process goes on, under which the patient succumbs, or gangrene proceeding from within outwards at the site of the puncture brings the case to an end.[1] This latter occurrence has resulted in nearly all the operations practised by me on Asiatics, and I have seen the same thing happen after similar operations on Europeans. Nature never acts in this way, but, as described by the authors above named, and often witnessed by myself, the proceeding is much slower; the pus escapes gradually from several small apertures, the cavity contracting slowly as the pus drains away, while hardly any air finds admission. I have attempted to imitate the process, by valve-like openings, by drawing off only portions of the purulent collection at a time, endeavoring to close the opening with the aid of collodion; I have tried to attain the same end by using a canula furnished with a stopcock but all in vain; sooner or later air entered, and the issue was unfortunate. I have lately, in a paper already alluded to ("Army Medical Reports," vol. vii.), suggested the use of Bowditch's syringe for this purpose. This instrument was constructed for evacuating pus, or fluid of any kind, from the cavity of the pleura without the admission of air. We use it at Netley, and find it answer the purpose perfectly. I have had an opportunity of trying it in one case of abscess of the liver, under the care of Mr. King Sampson of Southampton, with whom I saw the case in consultation. The patient, a young coffee-planter from Southern India, was landed at Southampton in a state of extreme prostration. There was no diffi-

[1] Would carbolic acid, used after the manner of Mr. Lister, be of use in preventing the decomposing action of atmospheric air admitted into such a cavity? It certainly would be worth trying, and there could be no difficulty in washing out the suppurating sac with the mixture of carbolic acid and linseed oil recommended by Mr. Lister, in the proportion, namely, of one part of the former to five of the latter.

culty in making out a well-defined abscess of the liver, which, although still rather deep-seated, obviously tended to the abdominal walls. It was determined to evacuate the abscess by Bowditch's syringe, which was done; a pint of pus was drawn off, to the great relief of the patient, through an aperture so minute, that the young man's parents could hardly see it, and could with difficulty be persuaded that the pus had come through what appeared to be merely a red point on the skin. No air entered the cavity. The young man sunk in about twenty-four hours after the operation from exhaustion, and possibly from the presence of other abscesses in the liver not accessible. Both Mr. Sampson and myself were satisfied that the instrument, if used sufficiently early in a suitable case, is admirably adapted to secure the end in view—the evacuation of pus without the admission of air into the sac. I hope that practitioners in India will give this method a fair trial, and publish the results.[1]

[See an account of Dr. Hammond's and Dr. Sims's experience, on a previous page.—H.]

In puncturing for hepatic abscess, is there any danger of wounding the gall-bladder? I saw this done by one of the most eminent surgeons in France, in one of the hospitals of Paris, more than twenty years ago. Morehead also appears to have heard of cases of this accident. The position of the swelling and its pyriform shape will lead to a correct diagnosis. The patient mentioned above was more deeply jaundiced than I have ever seen any one before or since. When an abscess of the liver is discharging, the utmost care must be taken to sustain the patient by suitable diet, by the use of light unbrandied wine, and, as soon as the case admits of it, by removal to a better climate.

Those who have been most conservative in treatment in the early days of the case will be more successful at this stage than the practitioners who, in their anxiety to prevent suppuration, have been prodigal of their patient's blood and strength.

In conclusion, I cannot avoid repeating an observation often made by me before, in the various discussions that have taken place of late years in the medical press on the subject of puncturing hepatic abscesses. It is this: The invalids from every foreign station garrisoned by the British Army pass through the Royal Victoria Hospital, Netley. Nothing is more common than to see men who have made excellent recoveries after the evacuation of hepatic abscesses through lung or bowel, nothing more rare than to see men with the cicatrix of such an abscess in the right hypochondrium, more particularly in an intercostal space. Where there is an external cicatrix, it is almost invariably situated just below the ensiform cartilage, verifying the *dictum* of Morehead as to the greater frequency of recoveries when abscesses pointing outwardly occur in the thin part of the right or well towards the left lobe.

[Operations with the aspirator (after the manner of Dieulafoy) have, of late years, by their success, increased the confidence of physicians in this method in abscess of the Liver.—H.]

Gangrenous Inflammation of the Liver.

This is a disease of which I know nothing from personal observation, save in the form spoken of in the preceding article, viz., as a sequel of suppurative inflammation from the decomposing action of atmospheric air admitted into the cavity of a hepatic abscess by surgical operation. I am quite aware that a deceptive appearance of gangrene often occurs from the blackening of the tissue in and around an abscess by gaseous emanations from the decomposed discharges. Dr. Budd (Diseases of the Liver) has cautioned us against falling into this error. In every case the gangrene was not confined to the liver, but extended to the tissues around the opening of the abdominal walls.

Several cases are mentioned by authors of gangrene of the liver following mortification in some remote part of the body. When this occurs, the affection is never confined to the liver, but is found also in other organs, more especially the lungs and spleen. Dr. Budd gives the details of a case of this kind, communicated to him by Mr. Busk, in which gangrene of the liver and other internal organs followed mortification of the toes from exposure to cold. The dead parts were removed, rigor set in, followed by typhoid symptoms, and death on the sixth day. Gangrene of the liver, lung, and spleen was found after death. Mr. Busk thus describes the appearances in his case "On the outside of it the liver was not discolored, and presented no marks of recent inflammation; when it was cut into, numerous ragged cavities of various sizes were found, containing hepatic substance in a state of complete gangrene, and reduced in many of them to a semi-fluid and ash-colored flocculent matter, separated by a very defined line from the surround-

[1] Since the above was in type, I have used this instrument again and again, and in some instances with the happiest results. In single abscesses tending to the surface, I have no hesitation in saying that it affords the best hope of a happy issue.—*Vide* "Army Medical Reports," vol. ix.

ing substance, which, in immediate contact with the gangrenous portions, was of a deep greenish slate color." (Budd, Diseases of the Liver.)

It is needless to add, that this rare affection is beyond the reach of curative treatment.

CHRONIC ATROPHY OF THE LIVER—CIRRHOSIS.

By Edward Goodeve, M.B.

Description.—Chronic atrophy of the liver occurs in three or four different anatomical conditions. The form most frequently met with, and therefore of the greatest clinical importance, is the disease called Cirrhosis, hobnailed liver, or granular liver. In the present article it is proposed to describe chiefly this form. The course of the disease, and the most important symptoms in all the varieties, are sufficiently alike to make the account of one form answer for all.

Cirrhosis is an insidious chronic disease, often commencing with apparently trivial symptoms, and those chiefly referable to the digestive organs; in other instances, however, beginning with hepatic pain and enlargement; proceeding in both cases slowly, sometimes very slowly, to considerable or extreme atrophy of the liver, with exhaustion, anæmia, ascites, and death.

The symptoms of the disease will probably be best understood by a study of the anatomical alterations which the liver and other organs undergo.

Pathology.—The first most obvious and striking change in the advanced stages of Cirrhosis is found in the size of the liver. This is greatly diminished—often to half its bulk; it presents a curious tuberculated or granular surface, the resemblance of which to the hobnails of shoes has obtained for it the name of hobnailed liver. From the yellow or yellowish color of parts of the surface of sections Laennec gave it the name of Cirrhosis.

The atrophied, *cirrhosed*, or contracted liver has undergone considerable changes throughout its structure. Externally it is of grayish-drab or whitish color: it is reduced to two-thirds or one-half its natural size; many specimens not exceeding 1 lb. 8 oz. or 2 lbs. in weight. The diminution is pretty uniform in most of the dimensions: the edges waste first, and are often reduced to a thin, almost membranous condition, with the nodular or tuberculated state existing where there are remains of parenchyma. The left lobe is usually more atrophied than the right; indeed, often appearing as a mere thin expansion attached to the right lobe. The thickness of the liver is not diminished in the same proportion as the other dimensions, so that as the organ is chiefly reduced in length and breadth, the remainder assumes a somewhat rounded or globular shape. The consistence is firm, tough, or leathery; the hardness is especially noted in the earlier stages of the disease. The capsule is generally opaque, adherent to the subjacent parenchyma; and, if there has been perihepatitis, it may be much thickened, and covered with false membranes or adhesions both on its upper and under surfaces, which may thereby be attached to the neighboring parts. In some cases the adhesions have lengthened out, as if by traction of a diminishing succeeding an enlarged liver. Both the superior and inferior surfaces are studded with semi-globular, sessile, warty prominences, varying in size from a pin's head to a quarter or half an inch in diameter: they are situated at variable distances from each other, often thick-set and touching at their bases. The nodules may be pretty uniform in size, sometimes not larger than hemp-seeds; but in the advanced stages they are often more unequal. On section, the nodular arrangement is found throughout the substance of the organ. The cut surface presents a collection of roundish and darkish patches, varying in size and shape, and separated from each other by intervening firm, whitish, fibrous-looking or cellular tissue: the arrangement has been compared to the vitellarium of the laying hen. The nodules are yellowish, sometimes bright yellow, from bile. Dr. Budd likens the color to that of impure beeswax. This affords a contrast to the whitish intermediate substance. The breadth of the white tissue varies from mere lines to spaces equal to the size of the lobules. The colored masses are the remaining secreting tissue, lobules or groups of lobules not yet

wasted or absorbed. There is thus a remarkable diminution of secreting tissue, and a real or apparent increase of white connective or areolar formation. The wasting of the lobules varies in degree in different parts of the liver.

Microscopic examination shows that great changes have also taken place in the minute structures, and especially in the cell-growth and capillaries of the lobules.

The cell-structure is greatly reduced: not only has the greater part of this entirely disappeared with the lobules, but that left in the remaining lobules is often found in different stages of alteration. A portion of the cells may be found healthy and bile-stained; but the greater number have undergone degeneration, become smaller or shrivelled up, or they may be dotted with or filled with oil. The color is generally yellow, but some are brownish. The cells of the periphery of the lobules are most wasted or altered.

The circulation of blood in the affected lobules is much interfered with, or entirely arrested, according to the degree of the waste of the secreting structures, owing to the disappearance of, or changes in the capillary plexuses. The walls of most of those which remain are granular, or contain oil-globules.[1] Fine injections of the portal vein do not penetrate the capillaries of the interior of the diseased lobules. The hepatic veins may be traced into the centres of the lobules, but their capillary ramifications have disappeared: a few branches, however, generally remain, become enlarged, and maintain the connection of the hepatic with the portal or veins of the periphery of the lobule. Through these changes, the communication between the portal and hepatic veins is nearly destroyed or interrupted, and the blood can no longer easily pass onwards. Even where the vessels in part still remain, the blood-channels are insufficient to continue the circulation fully, though a small quantity of portal blood may still pass onwards. The hepatic artery is said by Frerichs to become enlarged, and to develop new capillaries. Black pigment is sometimes found in its branches.

The white substance varies in quantity and hardness, and is generally supposed to be made up of fibrous tissue; but that this is not always correct appears from a case which was minutely examined by Dr. L. Beale,[2] and which may be supposed to represent, at all events, one form of Cirrhosis. In this instance it was not composed of fibrous tissue resulting from organized exudation, but was made up of numerous vessels, bile-ducts, and tissue consisting of altered and partly disintegrated vessels, cells, and other tissues, which existed in the healthy state of the organ. It was found to be penetrated in every direction by vessels of considerable size, but which, however, stopped short before entering the lobules. The bile-ducts were generally permeable to injections, and were traceable through the white matter. Their walls were granular, or filled with oil-globules.

Other observers describe the white substance in the cirrhosed liver as consisting of newly formed fibrous tissue, originating in marked exudation, which, undergoing contraction, causes compression of the vessels and lessening of vascularity. Frerichs says that, at the circumference of the lobules, fibrillated connective tissue is found, and that in the substance of the lobules the tissue has an amorphous character.[1]

The condition above described is that to which the liver is reduced in extreme states of Cirrhosis—a state of degeneration which it has reached in succession to previous changes only. Pathologists are not wholly agreed as to the processes which always precede atrophy. The same kind of doubt is entertained respecting the early stages of these as of the early stages of the contracted kidney. It has yet to be determined whether Cirrhosis is the result of a primary degenerative process, or of inflammatory exudation or congestion. It is probable that it may originate in either of these processes.

When it commences with inflammation or congestion, the course which leads to atrophy is as follows:—Fibrinous exudation takes place; this occupies the portal canals, and extends even into their minute ramifications, so that the very lobules may be separated by the exudation. Livers examined in this earlier stage are much enlarged, are firm and tough—sometimes very tough—the external surface, perhaps, merely uneven with commencing granulations, and the capsule more or less thickened and opaque. On section there is found considerable vascularity, an amorphous albuminous exudation, tailed or spindle-shaped cells and fibro-cellular tissue separating the lobules. In more advanced stages the fibrous tissue is more decidedly developed. Subsequent to the organization of the exudation, contraction follows, with constriction of the vessels lying in the course of the new tissue, impediment to the circulation in the small branches of the portal veins, starvation, and wasting of the tissue by them. Dr. Budd takes this view, and describes Cirrhosis as the result of adhesive

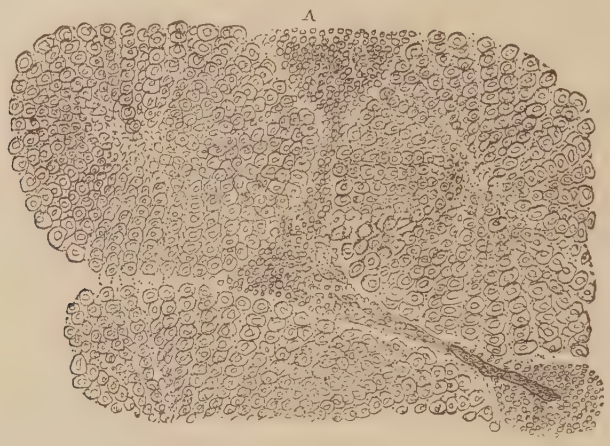
[1] Beale's Archives of Medicine, vol. i. p. 122.

[2] Ibid., vol. i. pp. 120, 121.

[1] Clinical Treatise on Diseases of Liver, New Sydenham Society's Translation, vol. ii. p. 28.

inflammation of the liver, involving the areolar tissue about the small twigs of the portal vein: by this inflammation serum and coagulable lymph are poured out, causing general swelling of the liver. This exudation subsequently loses its fluid part by absorption, becomes denser, separates the lobules into well-defined masses, and constricts the smaller branches of the portal vein. Wasting of the lobules ensues; those on the surface, and the islets of colored tissue seen in

[Fig. 63.



Indurating Inflammation of the Liver, first stage; with small-celled infiltration of interlobular vessels. × 300. (Rindfleisch.)]

sections, are congeries of lobules not yet wasted and absorbed; the yellow color depending upon some compression of the ducts, and consequent bile-staining. Dr. Budd thinks that when the exudation and thickening occupy the larger canals or passages, and cause compression of some of the larger branches only of the portal vein, atrophy of the part supplied by the branch is produced, without much alteration of the other portions, shown by drawing in or puckering of the surface.[1]

[Fig. 64.

Indurating Inflammation of the Liver, second stage. *a*. Bands of interlobular connective tissue. *b*. Groups of hepatic lobules with their periphery infiltrated with fat. × 200. (Rindfleisch.)]

Those who attribute Cirrhosis to degeneration of the secreting tissue, independently of inflammation, supposed that an unsuitable pabulum passing through the liver, as in the case of the long-continued consumption of alcoholic liquors, produces degeneration of its cell-tissue. This causes a smaller demand for, and a diminished afflux of, portal blood, and wasting and absorption of the lobular structure, leaving masses of white tissue which

[1] Budd, Diseases of Liver, 3d ed. pp. 144 and 183.

waste less rapidly than the lobules. That Cirrhosis may be produced in this way seems probable from the description given by Dr. Beale, already mentioned. He shows that, in the case named, the white substance was well provided with permeable vessels, and that the atrophy could not have been in that instance due to the constriction of the vessels merely: nevertheless, as their capillaries were obliterated, portal blood could not circulate in the lobules.

In considering the immediate causes of contraction of the liver, it seems impossible to doubt that in a large number of cases enlargement of the organ precedes the atrophy. Dr. Bright is confident of this.[1] In more than one instance in the post-mortem examination of cases of contracted liver I have myself seen proof of its great previous enlargement in the state of the adhesions connecting it to distant parts. I have seen the left margin of the liver attached to the left origin of the diaphragm by membranous adhesions three or four inches in length, showing that in some former state the edge had been in contact with the left origin of the muscle, and that during this time exudation upon the surface had taken place, which had been drawn out into thin sheets of adhesions by the slowly retreating liver. It is not unfrequently found that Cirrhosis has been preceded, three, four, or more years before its establishment, by well-marked pain and enlargement of the liver. Malarious enlargements sometimes end in Cirrhosis. Frerichs mentions that in some of these cases the portal capillaries have been found to be blocked up by pigmental deposit, so that they were impermeable to injection. I do not know that there is any good proof that the simple, painless, or nearly painless, enlargements of the liver frequently met with in tropical or malarious climates, unconnected with fatty or albuminous disease, terminate in Cirrhosis. It is probable that they do so sometimes; but it is by no means a necessary consequence. The enlargements from passive congestion, resulting from heart disease, are, if the patient survives long enough, often succeeded by an atrophied state, which in external appearances resembles Cirrhosis; and if the primary disease destroys life before there is extreme degeneration, the surface of the liver is occupied with small elevations, similar to those of the early stages of Cirrhosis.

It seems probable, then, that Cirrhosis, as before said, may originate in two ways —either as the result of primary degeneration of cell-growth or of inflammatory exudation. In both of these conditions, however, it is possible that cell-degeneration may be the step which originates the wasting of the capillaries of the portal veins and that even in the inflammatory variety this vital or functional disturbance plays a more important part than mere mechanical compression of the vessels. It is not impossible that in some cases compression of the bile-ducts may produce biliary stagnation and wasting of cells.

The other forms of atrophy of the liver remain to be briefly noticed. Atrophy may be partial, from pressure of tumors from above or below the gland. Depression of the diaphragm, from thoracic disease or from limited peritoneal exudations, may produce local absorption or depression.[1] Diminution of the liver, in common with other organs, attends many emaciating diseases and old age. Tight lacing also causes it. In cases of perihepatitis with much thickening and contraction of the capsule, and consequent general compression, atrophy may follow.

There is a form of chronic atrophy called *red atrophy* by Rokitansky, in contra-distinction to the chronic yellow atrophy. It is distinguished from the latter by the darkish-brown or bluish-red color of the organ. The liver is gorged with blood, and is of spongy elastic consistency. The outer and inner parts are free from granulations, and the surface of sections is of smooth and homogeneous texture. The organ is atrophied, the thickness preponderating over other dimensions. It is attended with venous plethora of the abdominal viscera. According to Frerichs,[2] the portal vein is enlarged up to its subdivision into capillaries at the periphery of the lobules, at

[Fig. 65.

Cirrhosis of Liver, showing new growth of connective tissue, causing atrophy of the liver cells. × 200. (Green.)]

[1] Guy's Hospital Reports, vol. i. p. 612.

[1] Frerichs, vol. i. p. 249.

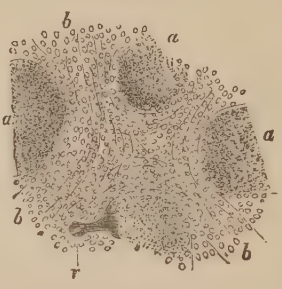
[2] Ibid. p. 253.

which point the enlargement terminates in club-shaped extremities. The walls of the veins are sometimes normal, but at others there is remarkable thickening of the sheath formed by Glisson's capsule. The hepatic capillaries are in great measure destroyed. They become filled with brown molecules, and contain flakes or granules of black pigment. The lobules are atrophied, and the capillary meshes contain only a few stunted cells. The veins of the stomach and intestines are frequently enlarged, and there may be sub-serous ecchymoses and mechanical congestions of the mucous membrane and of the spleen.[1]

Frerichs points out that the atrophy which follows the *passive congestion* in thoracic disease differs somewhat from true Cirrhosis in its minute anatomy. It has already been mentioned that, in the ordinary granular liver, the cells and other structures waste at the periphery of the lobules; but it is otherwise in passive hyperæmia. The congestion in this form affects the interlobular branches of the hepatic veins, causing stagnation of blood, distension, and atrophy which last by degrees extends to the parts supplied by the portal capillaries. In atrophy from passive congestion, the wasting commences at the centre, and in Cirrhosis at the periphery of the lobules. He says that this circumstance gives a different appearance to the sections, the granular state being marked by depression in the centre in the first, and at the circumference in the second case.

Of late years, carefully made observations have shown that constitutional *syphilis*, probably in its tertiary stages, produces contraction of the liver, preceded by interstitial inflammation and exudation. The resulting anatomical changes differ in appearance from those of common Cirrhosis. The surface is not hobnailed, and the atrophy is more localized, causing deep furrows leading to depressed cicatrices, more frequent in the upper than in the under surface of the liver, and dividing the organ into irregular masses. In well-marked cases the liver acquires a lobulated form of unequal divisions, as seen in the 6th figure of Frerich's second volume, page 166, and in which condition it has been likened to the kidney of the fœtal calf. In the earlier stages the exudation occupies chiefly certain ramifications of the capsule of Glisson, and the subsequent organization and contraction interfere with the nutrition of the parts supplied by the vessels of the tract involved. The exudation ultimately forms hard white spaces of fibrous tissue, or masses connected with the base of the furrows. In these new tissues the gummy syphilitic deposits are sometimes found. The conditions of

[Fig. 66.



Gummatous growth from Liver. *a*. Central portions of nodular growth containing granular débris. *b*. Peripheral granulation tissue. *r*. Bloodvessel. × 100.]

local atrophy observed by Dr. G. Budd, previously referred to, are probably illustrations of the disease in syphilitic subjects. Perihepatitis with adhesions to the diaphragm is pretty constant. More detailed accounts than can be given here will be found in the descriptions of Frerichs,[1] Wilks,[2] Murchison,[3] Berkeley Hill,[4] and Langereau.[5]

In whatever form the atrophy exists, whether under that of Cirrhosis, red atrophy, or that from passive congestion, the results in the extreme stages are impairment or wasting of the secreting structure, obliteration of the capillaries of the lobules, and obstruction to the current in the portal veins, with distension of its trunks and intestinal capillaries; the ultimate consequences being great reduction of the bile-producing capacity of the liver, portal congestion, imperfect digestion and nutrition, anæmia, and hemorrhages.

The changes which occur in other organs are in great part due to the obstruction to the portal circulation in the liver. Thrombi sometimes form in the branches or trunk of the portal vein; with or without this there are congestions, ecchymoses, rupture of capillaries, or hemorrhages affecting the stomach and intestines. Perhaps the stomach and small intestines are most liable to hemorrhage, but this may spring from any part of the canal. Sometimes abrasions and superficial ulcers of the mucous membrane

[1] Frerichs, vol. i. p. 253.

[1] Op. cit. vol. ii. pp. 150–166. Atlas, part ii. plate 4.

[2] Lancet, January, 1857; June, 1858.

[3] Op. cit. p. 241.

[4] Syphilis and Local Contagious Disorders, pp. 132, 133.

[5] Langereau, Treatise on Syphilis. New Sydenham Society Ed., vol. i. pp. 332–334.

are formed. Congestion of veins of the colon and rectum leads to ulcers, hemorrhages, symptoms of dysentery, and hemorrhoids. The disturbance of the circulation of the stomach causes imperfect digestion, difficult absorption, and impaired nutrition of the body. The mechanical impediment to the passage of blood through the liver compels it to find new channels to the heart. These new channels are formed in one or two situations. In one, an anastomosis is formed between the hemorrhoidal and the branches of the internal and the external iliac veins; in another, between the portal veins of the surface of the liver and the veins of the diaphragm and neighboring parts, through the medium of the adhesions connecting the liver with them, and also through some accessory branches of the portal veins, which reach the liver through the suspensory ligament, and maintain a connection with the walls of the abdomen and with the epigastric and internal mammary veins. When the umbilical vein remains pervious, blood flows back from the liver, and forms a remarkable anastomosis about the navel, which communicates with the mammary and other veins. Sappey denies that this really occurs, and thinks that the enlarged vessel in the suspensory ligament, usually taken for the umbilical vein, is the enlarged accessory vein just mentioned. Sappey was the first to point out the nature of this important collateral channel. By the anastomoses above mentioned a considerable quantity of blood may reach the venæ cavæ, direct from the intestines. The full establishment of the new circulation is marked by great development of the superficial abdominal veins in the hypogastric and epigastric regions; but deep and unseen veins are also involved, and their enlargement often precedes that of the superficial vessels. The spleen is often increased in size, apparently in more than half the cases; its enlargement is frequently limited by a thick and unyielding capsule. In the majority of advanced cases, the congestion gives rise to exhalation or transudation of fluid, through the coats of the loaded veins, into the peritoneal cavity, or to ascites quite independent of any general anasarca. The collection may be very considerable. The fluid is yellowish, and is rich in albumen.

The anæmia depends upon the imperfect nutrition from disturbance of the digestive process, and absorption by the portal veins, and probably also from the disordered function of the liver.

It is generally supposed that hepatic abscess is seldom or never found in Cirrhosis. I do not recollect meeting with this complication; but Dr. Morehead mentions its occurrence in four of his cases.[1] They were all preceded by dysentery, and may have been examples of pyæmic abscesses following the dysentery.

The morbid changes in other organs besides the liver may be summed up as those due to the mechanical effects of the atrophy, and are, as appears from the foregoing, congestion of the portal system of veins, hemorrhages, erosions or ulcers of the gastric or intestinal mucous membrane, hemorrhoids, enlargement of the deep and superficial abdominal veins, and ascites. Those due to bad digestion, imperfect nutrition, and sanguification, are partly attributable to the mechanical derangement, and partly to disturbed liver function,—as anæmia, purpura, tendency to ecchymoses and hemorrhages from spanæmia, jaundice. The kidney is occasionally congested, sometimes owing to the pressure of the fluid in ascites, and sometimes atrophied, probably in consequence of constitutional derangement common to it and the hepatic disease.

It sometimes happens that Cirrhosis exists with an enlarged liver. This occurs in cases of fatty or waxy degeneration coinciding with the Cirrhosis. In such cases the term atrophy applies to the secreting tissue, and not to the whole organ.

Etiology.—The immediate causes of atrophy of the liver have already been discussed. The remote causes of those forms not arising from tight lacing or wasting disease are, in Europe at all events, chiefly due to the abuse of alcoholic drinks. The term "gin-drinker's liver" applied to the most frequent form, Cirrhosis, probably indicates its origin pretty correctly in most cases. It may also be caused by the spread of the subacute form of inflammation or thickening along Glisson's capsule, originating in previous perihepatitis or some form of irritation, as in ulcers of the stomach. Atrophy also follows the hyperæmia from malarious fevers, and, probably, occasionally the enlargement and congestion which come of residence in tropical and malarious countries; also that arising from chronic heart-disease. It is supposed that the direct irritation of alcohol, in its passage from the intestines through the liver, causes the interstitial inflammation or enlargement or the cell-degeneration. It is possible, however, that there is also some constitutional vice engendered by spirit-drinking, and that there is more than simple local disease. The wide diffusion of degenerative processes, as in the heart and kidneys, which frequently coexist with Cirrhosis, seems to favor this view. Dr. Handfield Jones

[1] Clinical Researches on Disease in India, 2d ed. p. 424.

thinks that, in some instances, the change is rather of the nature of a degenerative process which causes hypertrophy and condensation of the fibrous tissue, than an inflammatory one—a change of a similar kind to that which produces cartilaginoid induration of the capsule of the spleen, stiffening of the valves of the heart, and contraction of its orifices.[1]

Age and Sex.—Cirrhosis is generally a disease of middle life, between the thirtieth and fiftieth year; but cases are sometimes found in much younger and much older persons. Bamberger found the limit of age to be fifteen and sixty-five in his patients. In the "Pathological Transactions" a case is mentioned in a child of eleven, and Frerichs has seen it in one of ten years of age. Men are more subject to the disease than women.

Symptoms. — The symptoms of the early stages of Cirrhosis depend upon the manner in which the disease commences —upon whether it sets in with active inflammation or not. When it begins without inflammation they are very obscure, and the complaint progresses slowly, and for some time without apparent change. In this form the symptoms are mostly referred to the digestive organs. There is flatulence, distension, sometimes nausea, and the other signs of labored digestion; the appetite generally poor or indifferent. At times the symptoms resemble those of catarrh of the stomach or intestines. The bowels are irregular, sometimes loose, with slimy evacuations, and at others constipated. The feces vary in color from natural to a light hue; occasionally a firm motion may consist of patches of light mixed with darker material, attributable to fluctuation in the amount of hepatic secretion; and sometimes they are covered with a thin layer of mucus. There may be a sense of weight or dull pain in the right hypochondrium, more or less persistent or recurrent; but this may be absent or too slight to be complained of. These symptoms may continue for months, with more or less severity, in spite of treatment, the patient getting slowly weaker, thinner, and more anæmic. Hemorrhoids frequently appear; to these succeed distension of the superficial abdominal veins, ascites, and often hemorrhage more or less profuse. The ascites may precede the full enlargement of the veins. The ascites increases, and anasarca of the lower limbs may come on. The dropsy interferes with the descent of the diaphragm, and this action is often further impeded by flatulence, so that great dyspnœa is caused.

[1] Jones and Sieveking's Pathological Anatomy, p. 554.

In the early stages the liver may be found larger than natural on percussion; but as the disease progresses the hepatic dulness will diminish, so that, when the atrophy is extreme, a narrow band of dulness is all that remains to indicate the position of the liver. There is sometimes well-marked jaundice, but this is not common in uncomplicated cases; usually, however, there is dinginess or sallowness of surface and slight yellowness of conjunctiva. In the beginning the urine may not be much altered; but when there is lessened absorption, owing to congestion of the portal veins, the urine may be much diminished. Dr. Parkes thinks a copious or even natural flow of urine a strong argument against the existence of any material amount of congestion or Cirrhosis.[1] Uric acid and lithates are often precipitated, frequently with reddish or pink coloring-matter. These last, however, are not peculiar to contracted livers. The proportion of urea varies with the character of the digestion. When the liver function is greatly interfered with, as in the later stages, leucine and tyrosine may appear. There is seldom much bile-pigment.

The general aspect of a patient with advanced Cirrhosis is alone almost diagnostic. The thin, pale, sallow, or dingy, pinched countenance, the skin dotted or spotted with petechiæ, the emaciated chest and legs, the swollen, globular abdomen, with the distended veins meandering over its surface, are remarkable and characteristic.

The sufferer may die with hemorrhages, purpura, dysenteric stools, or general asthenia. In some cases life ends with delirium, sopor, or coma of some days' duration, or with typhoid symptoms, or pneumonia or bronchitis. In many, however, the mind remains clear until the last, the patient dying of exhaustion.

In some patients the first alarming signs are hemorrhages, as, for instance, severe hæmatemesis, repeated or even fatal in the first attack (but this is rare), melæna, or repeated hemorrhages from some other part of the mucous membrane; sometimes, and perhaps more frequently than is observed, there is slight oozing of blood, which mingles with the contents of the bowels, and may not be recognized except upon microscopic examination. The hemorrhages may be, and perhaps are generally due to mechanical congestion; but probably in many instances they are combined with a diseased state of the blood, as they occur also in parts supplied by vessels not subject to portal obstruction, as from the nose and mouth.

In many instances, when the early

[1] Parkes on the Urine, p. 324.

symptoms are obscure, the first sign which attracts attention is the ascites. This is very characteristic. In typical cases it comes on without previous œdema of the lower extremities, differing in this from the dropsy of heart-disease.

The cases which begin with inflammation or congestion may have decided pain or tenderness in the hepatic region, increased by pressure, or by deep inspiration, or by certain positions. The pain depends a great deal on the situation of the inflammation, being most severe when it involves the capsule and the upper surface of the liver. The pain and uneasiness are more marked when the distension of the capsule by the engorged liver is rapid than when it is slow. The pain may last a few weeks, and disappear and return again, or it may exist in a slighter degree throughout the disease, or be more troublesome when the patient is in certain positions—probably when on his left side.

DURATION.—Cirrhosis is a very chronic disease. It often lasts three or four years, or even more, from the commencement of the derangement of the health to the setting in of marked symptoms of obstruction. After this the duration is more definite: it may be a few months or a year.

DIAGNOSIS.—Before the effects of Cirrhosis begin to show themselves the diagnosis is difficult. If with previous symptoms of disturbed digestion there is a history of previous liver enlargement or inflammation, or of spirit-drinking, or of exposure to malaria, a strong suspicion may be entertained that degenerative disease of the liver is going on. When there is considerable emaciation and absence of ascites and flatulence, the lumps or nodules may sometimes be felt through the skin. In some instances, and especially among hospital patients, there is less difficulty in coming to a conclusion, as the patient does not seek medical advice until the characteristic symptoms are well developed. In the early stages of the insidious forms, the disease often passes for aggravated permanent dyspepsia. It is well in all these persistent cases to examine carefully into the state of the liver itself, and of its secretions, the tendency to piles, hemorrhage, melæna, slimy motions, or microscopic intestinal hemorrhages. In ordinary dyspepsia the disease may last for years without much emaciation, but this is more marked in indigestion accompanying hepatic disease. The size of the liver should always be carefully inquired into, but it is only in the later stages that much additional information is derived therefrom. Of course, when a case is under observation from beginning to end, it may be possible to trace its progress from period to period; but this opportunity is not often found.

In advanced cases it is not probable that much difficulty will occur. The ascites must be distinguished from ovarian dropsy, hydatid cysts, effusion from peritonitis, and the ascites of general dropsy. From ovarian dropsy it differs in the position of dulness and the history of growth; from peritoneal effusion, by its coming on without previous symptoms of acute or chronic peritonitis; from general dropsy, by the abdomen becoming swollen first and the lower extremities subsequently, the absence of general puffiness or œdema of the surface, and of heart, lung, spleen, or kidney disease, though these may occasionally coexist. The condition of the superficial veins will help the diagnosis. Extreme collection of fluid in the peritoneal cavity from any cause may cause prominence of these veins: but in contracted liver the enlarged veins generally precede the ascites; in general anasarca the fulness of the veins comes on as a consequence of the pressure of the fluid on the inferior cava. The portal origin of the ascites being ascertained, there may be difficulty in discriminating between obstruction or obliteration of the trunk of the portal vein by thrombosis or the pressure of tumors or growths, or by the obstruction in the liver itself. The diagnosis may be assisted by the knowledge of the size of the liver, by the previous history of disturbed liver function, by the presence or absence of tumors pressing upon the vein. In thrombosis the obstruction is sudden, and the enlarged lower abdominal veins will be more rapidly developed than in cirrhosis; the fluid collects again after paracentesis, even more rapidly than in cirrhosis.

The size of the liver can sometimes be ascertained by repeated examinations only, the bowels being cleared of fecal accumulations and flatulence by aperient medicines or stimulating enemata. Its condition should be carefully investigated after paracentesis. It would not be possible to diagnose between the various forms of atrophy, unless indeed (as may occasionally be done), the nodules could be felt.

PROGNOSIS.—This is decidedly bad. Fatal results may not be immediate, but sooner or later they must be feared. When the disease is sufficiently developed to make diagnosis certain, it is, as far as is positively known, always progressive, though its rate may vary much. It is probable that in patients in whom very free collateral circulation is established the progress may be slower, as cases are on record in which ascites has disappeared when the various venous anastomoses

have been largely formed. It is possible that in such cases of free restoration of circulation by means of collateral channels, if the uninjured portion of the liver be sufficient for the purposes of life, and the atrophy arrested, that existence may be maintained; but there does not appear to be good evidence of such cases and results having occurred. I suspect that the downward progress of the disease will be slower also in those instances in which easy, slimy, mucous motions relieve the congested mucous membrane.

TREATMENT.—It is only in the early stage, in that of enlargement of the liver, that we can hope to arrest the disease by treatment. Remedies which relieve congestion and inflammation should be used. In the acute stages, leeches, blisters, and saline aperients. In the chronic stages of enlargement, iodide of potassium, muriate of ammonia, nitro-muriatic acid, internally; or, externally, fomentations, pediluvia, or baths with nitro-muriatic acid should be tried. In syphilitic forms mercury or iodide of potassium may be used, according to the patient's condition. Change from tropical or malarious countries to temperate ones, if chronic enlargement continues, should be resorted to. It is not that these chronic enlargements necessarily end in cirrhosis; but it is well not to run the risk in any case. As cirrhosis so often springs from spirit drinking, it is imperative to prohibit its use in any form, except under rare circumstances, and to prescribe a bland, nutritious, and unirritating and easily digestible diet. Hot spices are to be avoided. They are generally objected to in Europe; but it must be remembered that the natives of India consume them continually and continuously, without suffering particularly from cirrhosis.

When extensive degeneration of the liver has occurred, health cannot be restored, and it becomes a question how far the remaining tissue can be kept in its existing state, and how the symptoms may be palliated. We do not know how much healthy liver-tissue is necessary for existence; but it is probable that a large destruction of it is compatible with the maintenance of life. We can only hope to effect this object by supporting the general health, which may be summed up as consisting in the use of tonics, such as iron, quinine, strychnine, and pepsine, to assist the digestion. The skin should be kept warm, and warm baths occasionally used. Rest from business and care is necessary. It would be vain to enter into a description of the remedies for the various symptoms of acidity, flatulence, heartburn, hemorrhages, scorbutic, dysenteric, or typhoid conditions, or brain-disturbances. They are such as are usually applied in such cases. The ascites rarely yields for any time, though it may be lessened or be kept temporarily under by diuretics or purgatives. The most useful diuretics are squill, digitalis, and decoction of broom tops. The latter sometimes acts powerfully, when others fail. The combination of the pill digitalis and squill is a favorite remedy with some practitioners. The mercury should never be given when the patient is in any degree in a cachectic state. Purgatives are not so valuable in this as in ordinary dropsy. I have found that, when there is permanent portal congestion, they tend to produce irritation of the mucous membrane, scanty, mucous, or dysenteric stools. Still they should be tried cautiously. The compound-jalap powder in drachm doses may be given, and stopped if it produces straining or scanty evacuations: also elaterium in small doses.

When the collection of fluid is large, and the breathing difficult, tapping may be required, and is, indeed, the only remaining means that we possess for giving relief. It should not be too quickly resorted to, because, unfortunately, the fluid collects again very rapidly, and the operation requires speedy repetition, often in a week or ten days. Probably, the fluid exudes all the more rapidly, owing to pressure being lessened by the evacuation. It is better, however, to tap than to allow the patient to go on with great dyspnœa or suffering. This is of itself a very exhausting process—perhaps equally so as the loss of albumen caused by the rapid secretion. When the strength is good, an ordinary but small-sized trocar should be used; but I have for years, in cases of ascites of any kind, with great debility, employed for evacuating the fluid the small needle and canula used for exploring purposes, and which is not much larger than a worsted-needle. The patient lies on his side in bed, and the fluid escapes slowly, and without causing any exhaustion; gentle pressure being maintained. A piece of India-rubber tubing, slipped over the shield of the canula, serves to conduct the fluid into a basin, which may thus be collected without fatigue to the patient, and without wetting the bed.

ACUTE OR YELLOW ATROPHY OF THE LIVER.

By Edward Goodeve, M.B.

Description. —In this fatal disease there is rapid diminution and change of structure of the liver, with jaundice. It is very rare, and has already been alluded to, in the article on Jaundice, as one of the malignant forms of that disease. It has been accurately known for a few years only, having been first described by Rokitansky, in 1845.

Symptoms.—These are much the same as those of malignant jaundice, and will therefore need a brief notice only in this place. The jaundice may begin suddenly, and run a rapid downward course, or there may be at the outset a few days of preliminary disturbances. About half the cases begin in one way, and half in the other.

In those with preliminary stages the earlier symptoms may be mild, and give no indication of impending danger. The patient may, indeed, not seem to be really ill. The symptoms are debility, weariness, aching of limbs, disturbances of the digestive organs, nausea, vomiting, flatulence, pain and uneasiness in the epigastric or hepatic regions, constipation or diarrhœa, slight feverishness, or quickening of the pulse. After a few days' duration, these may be followed by jaundice, which is generally not so deep as in obstructive jaundice, and most marked in the upper parts of the body. In this state the alvine evacuations are not devoid of bile. So far the disease may, in severity, differ little from catarrhal or simple jaundice. While in this state, and apparently with but little warning, severe disturbances of the nervous system suddenly appear: these may be agitation, restlessness, jactitation, delirium, sopor, profound coma or convulsions, with involuntary stools and urine. The evacuations, as above stated, generally contain bile, but they may become clay-colored or white as the disease advances. There come on deep alterations of the blood, vomiting of dirty brownish fluid, or of grumous or coffee-grounds matter, hemorrhages from the intestinal canal and vagina, extravasations of blood, and petechiæ. The feverishness generally subsides, and the pulse falls, when the grave symptoms appear. Pressure on the liver during the insensibility often causes contraction of the muscles of the face and signs of shrinking from it. The urine is generally diminished, but not suppressed, is of dark color, contains bile-pigment, tyrosine, leucine, and less than the normal amount of urea and uric acid. Dr. Harley says that the acids may be found in the urine in this variety of jaundice; so that the jaundice is partly due to suppression and partly to absorption. Under the above complication of disease of the blood and brain the patient generally sinks. Towards the last, the pulse loses in strength and gains in frequency, and is liable to great fluctuation in number.

When the disease has made progress, the liver becomes much diminished in size, which is indicated by the progressive lessening of the hepatic dulness if there be time for daily examination. On percussion in the later stages, it is found to be reduced to a narrow band about an inch in breadth, in the hepatic region.

Morbid Anatomy.—It has been already mentioned, in the paper on Jaundice, that the liver is much diminished in this form. It has lost half or a third of its weight and size. The thickness is greatly reduced, often not exceeding an inch at its greatest. The liver looks as if flattened out; its edge is thin. The capsule is shrivelled or puckered; not thickened or infiltrated with exudation, but marked with ecchymoses and subperitoneal extravasations. The tissue is generally soft and flabby, and easily broken down, or even pulpy. Portions may be congested, and less wasted than the rest. On section, the color is orange-red or yellow, or rhubarb-color, sometimes greenish-yellow; some parts are pale, others dark and congested. The divisions of the acini or lobules have disappeared; the cell-structure is broken up, and in most parts destroyed; those cells which remain contain much oil, and are sometimes granular. In cases cut short before the full changes are completed, as in the case of death by hemorrhage in an early stage, part of the cells may be but little altered, while the others have disappeared and are replaced by oil or granular detritus. Crystals of tyrosine and leucine are met with in the liver-substance. Frerichs speaks of a dirty gray-

ish exudation being found in some parts of the organ in the earlier stages, but which has disappeared in the later ones: it is found between and separating the lobules, which are surrounded by congested vessels. Injections by the hepatic or portal veins stop short of the capillaries, and between the ramifications of these lie the disintegrated tissues and extravasated injection-matter.[1] The effect of the morbid process which the liver goes through is found in extreme cases to be the complete destruction of its secreting structure, disintegration and partial absorption of its component tissues, with the production of oil or fat.

The gall-ducts and gall-bladder are generally empty, or the latter may contain a little unhealthy bile or a little gray mucus. The passages are not obstructed.

The blood is generally altered in quality, coagulating imperfectly, and containing, especially in the hepatic veins, and sometimes in the cavities of the heart, tyrosine and leucine.

The spleen is pretty constantly enlarged, as are the kidneys; the epithelium of the latter being bile-stained and fatty.

Extravasations of blood, ecchymoses, and changes in the other organs are such as are met with in other states of malignant jaundice.

In a few instances the liver has been found in a state resembling cirrhosis. In these cases the tuberculated condition has probably not been caused by the acute disease, but this last has come on in a patient who was subject to cirrhosis.

Duration. — The duration of the stages is uncertain. The milder symptoms may last from two or three days to three or four weeks. The jaundice may not come on for some days after the appearance of the preliminary signs, and may itself precede the severe symptoms for some days. Sometimes, however, the jaundice sets in early, and with it grave cerebral symptoms rapidly come on.

In those cases in which there may be said to be no preliminary symptoms, the jaundice and coma may be the first symptoms observed, and the patient may continue in this state and die in the course of two or three days, or even less. The whole disease may be said to last from one or two days, in very rapid, to three or four weeks in the extremely slow cases.

Etiology. — The causes of acute yellow atrophy are involved in great obscurity. The disease has been known to attack several persons in the same locality, and sometimes to have put on a sort of epidemic character, suggesting the idea of the operation of blood-poisoning from some local or general external cause. In many cases it has followed mental emotions, such as fright, grief, despondency, and also venereal excesses and debauchery of various kinds.

There are two distinct points to be considered in the etiology of the disease: first, the cause of the liver disease, and, secondly, the cause of the malignant symptoms. Dr. Budd thinks that the liver-disease is caused by some noxious matter absorbed from the intestinal canal, either swallowed with the food or produced within the body through faulty digestion or assimilation.[1] Frerichs saw it in a case resembling abdominal typhus in its earlier symptoms. Dr. Murchison thinks it probable that the process leading to liver-atrophy is part of a general constitutional disturbance due to some blood-poisoning, as in typhus or other blood-diseases, and in the same way that fatty change in the liver is only one of a series of changes following phosphorus-poisoning.[2] Although in the present state of our knowledge it is impossible to pronounce with certainty on this point, there is much probability in it; but it is also quite possible that the liver-disease may be due to blood-poisoning, and yet be the only local change that may be called primary, while the alterations in the other organs may be secondary.

The question of the cause of the malignant symptoms has been treated in the section on Jaundice. They are probably due to the blood-changes associated with renal derangement.

The intimate nature of the morbid process leading to the diminution of the liver is a subject of doubt. Frerichs thinks that the liver-disease is essentially a diffused or parenchymatous inflammation, with scanty exudation and fatty degeneration of the cells and other tissues of the lobules, leading to disintegration and absorption of the degenerated structures. The earlier steps of the process, however, have not been proved. Frerichs speaks of a grayish exudation in certain parts of the liver examined in the earlier stages, and which disappear in the later ones. Professor Bamberger and Dr. Murchison attribute the atrophy to diffused inflammation and rapid fatty degeneration of the tissue. If Frerichs is correct, the atrophy should be preceded by some enlargement during the exudation stage. This condition has not been observed during life; but, as he states truly enough, attention has not been

[1] Frerichs, New Sydenham Society's Translation, vol. i. p. 225.

[1] 2d ed. op. cit.

[2] Lectures on Diseases of the Liver, p. 346.

sufficiently directed to the early state of the liver to enable that point to be determined. Wedl speaks of the disease as a diffused hepatitis, in which the parenchyma of the organs is softened in consequence of an albuminous exudation.

Age and Sex.—The young are more frequently attacked than the old or middle-aged. Frerichs considers the majority of attacks occur between the ages of twenty and thirty.[1] Women are more subject than men; and pregnant females suffer more than others of their sex.

Diagnosis.—This is founded upon the general signs of jaundice, as mentioned in that article, and upon the size of the liver and rapid decrease under examinations, as ascertained by percussion. It may be mentioned, however, that it is difficult, even in a spare person, to ascertain the real size of the liver, and that the investigation requires great care. The occurrence of tyrosine and leucine greatly assist the diagnosis, and should always be sought for when possible to collect the urine.

Prognosis. — This is bad. A very small number of cases of malignant jaundice recover, and it is doubtful if those which have done so were instances of yellow atrophy. In the earlier stages, the signs are not sufficiently established to enable an opinion as to the real nature of the disease to be formed with confidence.

Treatment.—Little more can be said on this point than has already been done under the head of Malignant Jaundice, and the reader is therefore referred to that article. It is obvious that, if any success is to be expected, it must be in the early stages. When almost universal or extensive alteration and destruction of the secreting structure of the liver have taken place, no remedies can be of avail.

FATTY LIVER.

By J. Warburton Begbie, M.D., F.R.C.P.E.

General History.—Fatty liver, or fatty degeneration of the liver, is one of the recognized forms of painless enlargement of the liver, the morbid change being due to the abnormal deposition of oil or fat in the organ. To the existence of this particular disease attention was first prominently directed by the French physicians, and more especially by M. Louis, who had found it to be a not uncommon accompaniment of phthisis.

By French writers it has been styled "La Transformation graisseuse du Foie," "État gras du Foie." By the Germans it is known under the names of "Die Fettleber," "Hepar adiposum."

There exist very considerable difficulties in the way of offering an accurate clinical history of fatty liver, owing to the frequent absence of those features which indicate during life the precise nature of the hepatic enlargement, in particular instances. It is on this account that Louis is found expressing himself as follows:[2]—"Toute-fois, si j'admets que le passage du foie à l'état gras peut être aigu ou chronique, c'est seulement à cause de la dépendance qui existe entre cette lésion et la phthisie; car nous manquons de signes capables de la faire reconnaître à une époque quelconque de sa durée. En vain j'ai été au-devant des symptômes qui pourraient lui appartenir, je n'en ai recueilli aucun : les malades n'éprouvaient pas de douleurs dans l'hypochondre droit; la pression sur le foie, quand il dépassait le bord des côtes, n'en produisait pas davantage; et si elle était douloureuse à l'épigastre, dans les cas où le foie l'occupait, on en trouvait la raison dans l'état de la membrane muqueuse de l'estomac. Une seule fois j'ai vu la couleur de la peau altérée." Again, a little further on, in the same connection, Louis remarks:—"Dans cette absence de symptômes propres, une seule circonstance peut faire soupçonner l'état pathologique du foie; je veux parler de l'augmentation de son volume, puisqu'elle existe presque toujours dans le cas dont il s'agit."

The first edition of Louis' celebrated work was published in 1825, and the second in 1843, in both of which the passage now quoted, with a slight variation in the latter, occurs. Nine years subsequently to the appearance of the

[1] Lectures on Diseases of the Liver, vol. i. p. 234.

[2] Recherches anatomiques, pathologiques et thérapeutiques sur la Phthisie. Deuxième édition, p. 119.

earlier edition, Dr. Addison, in the course of his interesting "Observations on Fatty Degeneration of the Liver," took occasion to quote some of these observations, prefacing them with the remark:[1] "We find the utter barrenness of diagnosis upon this matter well illustrated in the candid avowal of the accomplished and experienced M. Louis." Dr. Addison further observed: "This want of information is, probably, in a great measure attributable to our inability to recognize the disease during the life of the patient; for as we then entertained no suspicion of its existence, we fail to make the minute and connected observation of facts so necessary to the elucidation of every internal affection." And much more recently, Frerichs,[2] in his valuable work, in directing attention to the subject of fatty liver, refers to the observations of Louis already quoted, and in doing so admits their appositeness.

In endeavoring to determine the precise nature and pathological importance of fatty liver, it is necessary to hold in remembrance that in the healthy liver of man there is always present some amount of uncombined oil or fat. The amount of fat in the liver of healthy adults is probably equal to three or four per cent. of the whole liver-substance. This fat is contained in the secreting cells of the liver; and these cells, at certain times and under certain conditions, are constantly filled with fat. In the fœtus, usually a large quantity of fine oil-globules is to be found in the cells of the liver; these are scattered through the interior of the cells, and do not run together so as to form large drops, as is frequently noticed in the more advanced periods of life. Frerichs observes that he has frequently examined the fœtal liver in man and the lower animals, and repeatedly, although by no means invariably, noticed oil-globules "Fettetröpfchen" in the cells. From this circumstance, namely, the varying amount of fat in the fœtal liver, Frerichs concludes that the fatty contents rise and fall in relation to certain definite periods of development; and that these are also possibly influenced by pathological conditions. After birth, and as life advances, the variation in the amount of the fatty contents of the liver is determined by many different causes. Of these diet is one of the most important.[1]

The well-known experiments of Magendie demonstrated the fact that, by feeding dogs on butter, the liver became very fatty. In one of Magendie's experiments a dog was kept exclusively on fresh butter, which it continued to eat, although not with regularity, for sixty-eight days. The animal then perished from inanition. Nevertheless, it was remarkably fat. While the experiment lasted, the dog had a strong odor of butyric acid, its hair was greasy, and its skin covered with a layer of fat. On dissection, the whole of the organs and tissues of the body were found infiltrated with fat. The liver was fatty, and yielded on analysis a large quantity of stearine, but little or no oleine: it had acted as a kind of filter for the butter. The general results of the experiments of

[1] Guy's Hospital Reports, first series, vol. i. p. 479: 1836. See also a Collection of the published writings of the late Thomas Addison, M.D., p. 99 (New Sydenham Society, 1868).

[2] Klinik der Leberkrankheiten. Erster Band, Seite 285. 1858. "Vergebens," observes Frerichs, "war man indess bemüht, nach klinischen Beobachtungen ein klar gezeichnetes Krankheitsbild für diese anatomische Läsion zu entwerfen: so vielfach man derselben bei Leichenöffnungen begegnete, so wenig zuverlässige Anhaltspunkte gewann man für die Diagnose während des Lebens; eine genügende Symptomatologie der Fettleber liess sich nicht construiren. Est gilt in mancher Beziehung noch heute, was Louis vor Jahren in seinen Recherch. sur la Phthisie hierüber aussprach."

[1] "Anciently," remarks Dr. Thomas Willis, "there was an art with the Romans so to feed a goose that the liver, prodigiously increased, might weigh more than the whole body." "Of other Hepatick Remedies," section 2, chapter ii., of Pharmaceutice Rationalis; or, "An Exercitation of the Operations of Medicines in Humane Bodies." (London, 1679.) This art, as is well known, is still practised. Barron Larrey gives the following account of it: "To procure the large livers of geese for the making of patties, fatted birds are confined in close cages, and then exposed to a graduated heat, being kept at the same time entirely without food — even without water. They become feverish; the fat undergoes a kind of fusion, and the liver grows enormously large. The liver is considered to be in the desired state when the animal is *extremely wasted*, and the fever increases." Upon this account of the late Baron, Dr. Budd comments as follows: "Baron Larrey was a native of the South of France, and the account cited was probably derived from personal observation; but at present, as far as I can learn, there is in the fattening of ducks and geese in France only one method employed, which consists in keeping the birds in a dark place, with little space to move in, and in cramming them with a paste of maize or some other farinaceous food, allowing them water to drink at will. Under this treatment there is at first a general increase of fat in the body; but when the fat stored up throughout the body has reached a certain amount, the further increment of fat appears to be deposited chiefly in the liver, which soon passes into the fatty state that is so much prized. The color of the fat in any particular bird varies with the color of the maize on which it was fattened."—Diseases of the Liver, p. 303.

a like nature undertaken by Magendie were, that the animals became very fat, but their muscles much wasted; in some of them the cornea sloughed, and the animals ultimately perished from inanition. In all of them, the liver was found to be fatty. In connection with the fatty condition of the liver, Magendie noticed that the skin of the dogs assumed an oily character, and that volatile fatty acids were secreted by the sebaceous glands. This observation of Magendie is of much interest in relation to the description which Dr. Addison gave of the peculiar appearance presented by the integuments in those persons who were suffering from fatty degeneration of the liver in a marked degree. This appearance, when well marked, Dr. Addison regarded as "indicative, if not pathognomonic, of fatty degeneration of the liver."[1] To this condition of the integuments, as described by Dr. Addison, attention will be directed when treating of the symptomatology of fatty liver. It is not merely food rich in fat which determines such a condition of the liver as Magendie described, but other kinds of food, when taken in too large amount. In such circumstances, however, it has been observed that the deposition of fat in the liver does not occur until the cellular tissue and other organs and tissues of the body have become loaded with fat, and the serum of the blood has assumed a milky appearance. There is such a thing as a fatty condition of the liver stopping short of a truly morbid state; for the former is from time to time found in persons who have died suddenly while in unimpaired health. It is in these instances a temporary or passing phenomenon. Frerichs mentions that he has found the liver very fatty ("sehr fettreich") in a railway functionary who was killed at his employment, also in a mason who had perished by a sudden and violent fall; and the same writer states that he has several times found a similar condition in those who had died after a few days' illness, in the eruptive stage of the acute exanthemata, scarlet fever, and measles. We look for the occurrence of fatty liver in persons who lead indolent lives, and are at the same time gross feeders, more particularly if their consumption of fatty articles of food is considerable. In individuals of this class the deposit of fat in the liver is almost invariably associated with an excess of subcutaneous fat, as well as its increase about the kidneys, in the omentum, and those other places where its presence is common. In intimate relation with the quality and quantity of food, there are other circumstances requiring consideration, namely, climate and peculiarities of constitution. Fat cannot be taken by certain persons without producing more or less disorder of the digestive and assimilating functions; others are able to take fatty articles of food without any apparent suffering or derangement being caused, but they remain lean—the fat is either not digested or not assimilated by them; a third class not only take such articles of food, but, by their use, grow fat. Before passing from the consideration of the influence on the development of fat in the economy, and specially its deposition in the liver, produced by diet, it is necessary to state specifically, that persons who drink immoderately of alcoholic liquors, and at the same time take little exercise, are apt to become affected by fatty liver. Dr. Budd[1] mentions "porter and other heavy malt liquors" as producing this effect. Dr. Murchison[2] signalizes "ardent spirits," and states regarding two fatal cases of delirium tremens in which an autopsy was made by him in the Middlesex Hospital, some years ago, that in both there was considerable fatty enlargement of the liver. Dr. Begbie[3] has referred to the influence exerted by "the continued daily use, for a few weeks at a time, of a mixture of spirits and water, with sugar," in producing liver derangement, and with it a manifest increase of fat, which subsided on the disuse of the stimulating drink. Frerichs, in alluding to the frequency of fatty liver in relation to different diseases, after assigning the first place to tubercular disease of the lungs, remarks, Next in order comes the drinker's dyscrasia ("Sauferdyscrasie"). Of thirteen individuals who died of delirium tremens, the liver was very fatty in six ("eine sehr fettreiche Leber"), in three the organ contained little fat, and in two there was no fat: finally, two died of cirrhosis of the liver.

We turn now to consider a little more fully the relation of fatty liver to phthisis, and particularly to pulmonary tuberculosis, a disease uniformly attended by much wasting and emaciation, and by the disappearance in particular, of all subcutaneous fat.

The frequency of the occurrence of fatty liver in phthisis was first noticed by Louis.[4] It existed in one-third of the subjects—in forty out of one hundred and twenty. The same writer remarks, "La transformation graisseuse du foie existe presque uniquement chez les individus

[1] Dr. Addison's Works, p. 101.

[1] Diseases of the Liver, p. 295.

[2] Clinical Lectures on Diseases of the Liver, p. 48.

[3] Contributions to Practical Medicine, p. 214.

[4] "La transformation *graisseuse* du foie était la lésion la plus fréquente et la plus remarquable de ce viscéra."—Op. cit. p. 116.

atteints de phthisie ; en sorte qu'on peut, jusqu'à un certain point, la considérer comme une dépendance de cette affection." The ultimate relationship of fatty liver and tubercular disease of the lungs is further evidenced by the statement of Louis, that, of two hundred and thirty persons who died of acute and chronic diseases other than phthisis, in nine only was the liver found to be fatty, and of these nine there were seven in which a certain number of tubercles existed in the lungs. The fact, brought to light by the distinguished French physician, has been confirmed by many subsequent observers. Dr. Budd remarks, "Fatty degeneration of the liver, in a high degree, is not only frequent in phthisis, but—setting aside the persons in whom the liver is loaded with fat in common with the areolar tissue and other parts of the body in which fat is liable to be deposited—is almost peculiar to this disease."[1] Frerichs observes, "Among the pathological conditions which influence the origin of fatty liver, tuberculosis of the lungs occupies the first place."[2] Of one hundred and seventeen cases of this kind, in seventeen cases the infiltration was extreme ("höchsten Grades"), and in sixty-two the liver-cells were rich in fat. Dr. Murchison, in fifty-two autopsies of persons dying from tubercle, found the liver fatty in twenty. And the same writer speaks of the "great frequency of fatty enlargement of the liver in persons suffering from pulmonary consumption."[3]

There are a few further particulars of interest to note in reference to this subject. Fatty degeneration of the liver in phthisis occurs irrespective of age, and appears to be of equal frequency in the acute and chronic cases of the malady. Not so, however, in respect to sex. "Le sexe est encore," Louis observes, "une des causes qui favorisent la transformation graisseuse du foie." Of forty-nine instances of fatty liver in tubercular subjects, only two were males. "Das weibliche Geschlecht ist häufiger mit dieser Veränderung des Leberparenchyms behaftet als das männliche"[4] is the statement of Frerichs. And he gives the proportion of males as one to 3·5, while that of females is one to 2·2. So also Dr. Murchison remarks, "In consumptive females it (fatty liver) is much more common than in males."[5]

It is of importance to notice the remarkable contrast offered by the relationship of fatty liver to other diseases of the lungs than the tubercular. Neither in pneumonia, nor in pleurisy, nor in emphysema is a fatty condition of the liver observed with any frequency. Formerly, indeed, it had been supposed that the interference to the due performance of the respiratory function, owing to the disease of the lungs existing in phthisis, was the cause of the accumulation of fatty matter in the liver in cases of that disease.[1] This view, however, was rendered very improbable, when it was discovered that in diseases of the heart which produced great interference with the respiration, in asthma, and in catarrhal disorders, severe and lasting, the liver did not become fatty. The fact now established is, that the fatty condition of the liver is intimately connected, not with pulmonary disease, but with a particular form of pulmonary disease ; that the fatty liver is, in the words of Rokitansky, "an essential constituent or pathognomonic combination of the tubercular dyscrasia, inasmuch as it allies itself with tubercular affections of every kind, with tubercle of the intestinal mucous membrane, of the bronchial glands, the serous membranes, the bones, &c."[2]

There are other diseases, attended by much wasting, with which fatty liver is associated. Cancer is one of them ; so is the simple ulcer of the stomach ; and chronic dysentery is a third. As to the first mentioned, it has been frequently observed that in persons suffering from cancer, although much emaciated, fat has accumulated in the immediate neighborhood of the cancerous development. Cruveilhier noticed this ; and Dr. Budd has stated, that "the most fatty liver that has fallen under my own observation for several years was that of a man who died in King's College Hospital, in April 1844, at the age of thirty-six, of extensive cancerous ulceration of the groins."[3] Dr. Murchison refers to cases of simple ulcer of the stomach connected with fatty liver, as recorded by Mr. R. Robinson (Pathological Transactions, vol. iv. p. 133) and by Mr. H. Thompson (in the same work, vol. vi. p. 186). With chronic dysentery,

[1] Op. cit. p. 298.
[2] Op. cit. p. 309.
[3] Op. cit. p. 48.
[4] Op. cit. p. 309.
[5] Op. cit. p. 48.

[1] The following passage, for example, occurs in the treatise of Andral : "Presque tous les cas de dégénération graisseuse du foie s'observent chez des phthisiques, c'est-à-dire, chez des individus dont le sang n'est plus convenablement élaboré, et dont l'exhalation pulmonaire ne peut plus s'accomplir comme dans l'état normal ; serait-ce parce que chez les phthisiques une suffisante quantité d'hydrogène cesse d'être expulsée par la muqueuse bronchique sous formé de vapeur aqueuse, que chez eux ce principe vient à se séparer en excès de la masse du sang au sein du parenchyme hepatique ? De là, formation de matière grasse dans le foie."—*Cours de Pathologie Interne*, tome deuxième, p. 369.

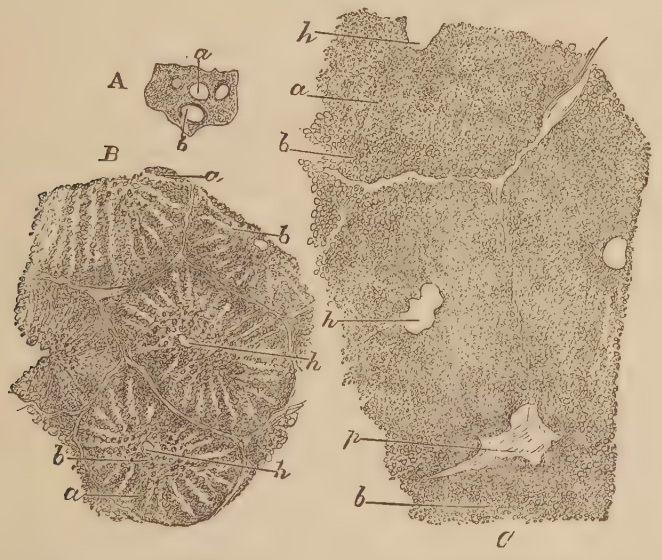
[2] A Manual of Pathological Anatomy, vol. ii. p. 120, Sydenham Society's edition.

[3] Op. cit. p. 299.

fatty liver has been found associated by Dr. Bright (Hospital Reports, vol. i. p. 117), by Mr. Busk, and Dr. Budd. To one other, and that a very interesting association of the enlarged and fatty liver with a particular form of disease, reference must be made. "Of the frequent coexistence," writes Dr. West, "of the enlarged and fatty liver with spasm of the glottis there can be no doubt."[1] Of this association Mr. Hood offered a mechanical explanation—the enlarged liver, in his opinion, leading to the trouble of respiration by the impediment offered to the descent of the diaphragm. Dr. West, however after referring to some observations of Dr. Rolleston, which connected fatty liver with the hydrocephaloid disease of children, points out the much more probable dependence of the nervous disorder, in both cases, on the imperfect depuration of the blood in the disordered liver.

Appearance and Characters of Fatty Liver.—The organ is enlarged,[1] the increase in size taking place for the most part in the lateral direction. The form of the liver is generally preserved to a considerable extent; its surface is smooth, its edges flattened and swollen, the lower margin of the organ being sometimes more distinctly rounded. An enlarged fatty liver may be distinguished from a waxy enlargement of the liver, by being less resistant to pressure and of softer consistence than the latter. The fatty liver is flabby, and on that account is, during life, capable of being pushed aside by the fingers, and it readily ruptures on pressure directly applied. The peritoneal covering is smooth, shining, and tense. In color, the fatty liver is uniformly yellowish red or light yellow. Rokitansky compares the color to that of autumnal foliage. The paleness of the

[Fig. 67.



Fatty Infiltration of Liver. A. Hepatic cell containing fat drops, *b*, and granules; *a*, normal granules. × 200. B. Fatty infiltration of hepatic cells during lactation; preparation treated with osmic acid. *a*. Peripheral normal cells; *b*, central drops, stained black with osmic acid; *h*, central vein. × 40. C. Fatty infiltration of cells at the periphery of the lobule; *h*, central vein; *p*, portal vein; *b*, peripheral fatty infiltration; *a*, normal central cells. × 40. (Cornil and Ranvier.)]

liver is associated with a diminished quantity of blood, or anæmia. The existence of fat or oil in the liver is easily proved by the deposit which is left on the dry warm blade of a knife by which it has been cut, or by subjecting the organ to an elevated temperature. In reference to the quantity of fat which is deposited in the advanced stages of the fatty degeneration of the liver, Frerichs remarks that it may be very considerable ("sehr beträchtlich"); and the same author mentions one case in which the amount of fat was equal to nearly four times that of the other portions of the organ.

The essential morbid condition in fatty liver is described by Rokitansky as con-

[1] Lectures on the Diseases of Infancy and Childhood, p. 184.

[1] It is not always so: the liver may be diminished in size and weight. Frerichs observes, "Neben den voluminöseren Fettlebern kommen atrophische vor, welche an Umfang wie an Gewicht weit unter der Norm stehen, obgleich ihr Fettgehalt ein sehr bedeutender ist. Solche atrophische Formen gehören keineswegs zu den seltenen."—P. 304.

sisting "in a deposition of free adipose tissue to such an extent as not only to replace the true glandular structure, but to penetrate the entire parenchyma, to the exclusion of the vascular tissue."[1] But while this condition in its exquisite or notable degrees is easily recognized, there are minor varieties of the same, in which the size, form, color, and consistence of the liver are altered in such a way as to be by no means readily distinguished from certain other morbid changes to which the organ is subject. Accordingly, recourse in such instances must be had to a careful microscopical examination.[2] In fatty liver the deposit of fat takes place in the secreting cells: to these, indeed, it is always limited.[3] In the preparation of a portion of fatty liver for examination under the microscope, it is of importance to hold in view that the hepatic cells are apt to be injured; thus the fat-globules escape, and appear to lie external to the cells. At first the fat is deposited in the form of fine little drops in the interior of the cells, and ordinarily in proximity to the nucleus, but sometimes in other parts of the cell. These fat-drops increase in number and size, and approach one another; the granular and brown molecules diminish, and the nucleus becomes invisible. Lereboullet and Frerichs differ as to the behavior of the nucleus: the former believes that he has ascertained the nucleus to perish when the deposit of fat has reached an advanced stage, while the latter affirms that, on the removal of the fat by the addition of oil of turpentine, the nucleus in most instances becomes apparent, and only disappears when the accumulation of fat is excessive, and not always even then. Ultimately the little drops of fat coalesce, forming two, three, or four larger drops; and these again often run together so as to form one very large drop almost filling the cavity of the cell.[4] The cells enlarge through the accumulation of the fat, and their form becomes altered; they cease to be angular, and are observed to be more round. As the fat increases, the other contents of the cells diminish and disappear—the fine granular matter and the albuminous substance, and above all, the brown or yellow granules and globules, which are the product of the secreting function. Frerichs, whose account of the minute appearances in fatty liver we have closely followed, further remarks that the changes in the hepatic cells begin almost invariably at the periphery of the lobules in the province of the interlobular vessels which contribute to the portal vein.

Pathological Import of Fatty Liver.—In their discussion of the essential nature of the fatty degeneration of the liver, it is common to find it described, by different authors, as a variety of atrophy. Whilst this view of the pathological change in fatty liver has been adopted by such observers as Andral, William Thomson, Barlow, Cruveilhier, Wedl, and Heroch, they differ materially, as Frerichs has pointed out, regarding the causes of the degeneration. Frerichs admits that fatty liver sometimes commences in a disturbance of nutrition of the liver-cells ("einer Nutritionsstörung der Leberzellen"). In such instances the appearance of an excessive amount of fat in the cells is preceded by their occupation with an abnormal plasma, and this in turn gives rise to the conversion into fat of the cell-contents. But this is not the explanation of the occurrence of fatty liver in the large proportion of cases. In such the fat is taken up into the cells from without. This reception is intimately connected with the functional activity of these structures: it increases or diminishes according to the nature of the ingesta, the richness of the blood in fat, the greater or less activity in secretion of the gland, &c. The liver acts the part of a reservoir for the surplus fat which has been absorbed, and functional derangements only occur when, owing to the overloading of the cells with fat, their other contents are compressed, and the circulation through the portal vein interfered with. When the fat has been removed from the cells by re-absorption, these damages may be removed. Such is a brief account of the view ex-

[1] Op. cit. p. 120.

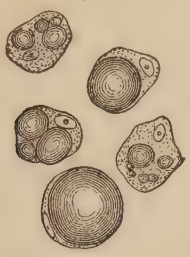
[2] Frerichs remarks, "Volle Gewissheit des Urtheils giebt hier nur das Mikroskop." Op. cit. p. 302.

[3] Such, at least, is the ordinarily received opinion. Frerichs expressly states that he has never discovered deposits of fat otherwise than in the cells. "Die Fettablagerung in der Leber ist, so weit meine Erfahrungen reichen, stets auf die Zellen beschränkt; niemals habe ich, auch bei den höchsten Graden dieser Veränderung, Deposita von Fett in den Intercellularräumen des Parenchyms entdecken können."

[4] Fat deposited in the hepatic cells is essentially fluid; in other words, the ordinary form of the fatty matter consists chiefly of olein. Vogel, Lereboullet, and Dr. Budd describe crystallized masses, which consisted probably of margarin, as having been detected in fatty livers by the microscope; but this, according to Frerichs, is a rare appearance. Cholesterine, notwithstanding its constant existence in human bile, has never been found as an interstitial deposit in the substance of the liver. Stearin has not been found in the liver of man, but has been detected (almost to the exclusion of olein, as in Magendie's experiment) in the liver of the dog, and of other animals, when these have been fed exclusively on fatty substances.

pressed by Frerichs regarding this physiological change in the liver, and which for a time, at all events, stops short of inducing really structural disease.

[Fig. 68.



Liver cells, in various stages of fatty infiltration. × 300. (Rindfleisch.)]

It is not to be lost sight of, that the presence of fat in the liver-cells is not morbid; but that the increased or excessive amount of fat in the organ constitutes disease. Deposition of fat in the liver-cells is a natural physiological process—one which is continually at work, and the activity of which, with its subsequent reabsorption of the fatty matters, is determined by the nature of the food, whether rich in fat or not, and the consequent impregnation of the blood with the same material. It is only when the character of the food has for a lengthened period been faulty, and when habits of life predisposing to excessive fatty accumulation have been long indulged in, that the process ceases to be a physiological one, and that disease is engendered.

The intimate connection subsisting between fatty liver and tubercular diseases and the intemperate use of alcoholic drinks has already been pointed out. In these circumstances the morbid change is more apt to prove lasting, entailing those local alterations in the liver-structure to which attention has already been called, and leading to derangement of its function, and, through that, to other disturbances of the system generally.

Symptomatology and Diagnosis.—Enlargement of the liver is one of the most striking features in the symptomatology of this form of disease, and one of the most important in its diagnosis; because, although an absence of enlargement is consistent with considerable fatty degeneration of the organ, the former is infinitely more common in its occurrence. The enlargement may be considerable, but it seldom equals the size attained by the waxy or amyloid liver, or that is sometimes reached by the carcinomatous liver. The enlargement is for the most part uniform, and the natural form of the liver is preserved. The fatty liver is less resistant to pressure, and of softer consistence, than the waxy disease. The outer surface is smooth, and the lower border usually rounded. Ascites rarely accompanies fatty liver, neither do the superficial abdominal veins become enlarged. Jaundice is not a common symptom; indeed, a notable degree of jaundice may be said never to occur. But the excretion of bile is interfered with, and it may become obstructed. This result is brought about mechanically, by the pressure of the distended hepatic cells on the minute ducts; and sometimes the larger ducts share in the compression. The capillaries are likewise subjected to pressure; and in consequence the liver in an advanced stage of fatty degeneration is always more or less anæmic. While the interference with the portal circulation is not such as to produce dropsy, it may give rise to passive congestion of the gastro-intestinal mucous surface, and so induce catarrhal affections, dyspepsia, diarrhœa, and hemorrhoidal suffering. It rarely induces the splenic enlargements which are not uncommon in cases of cirrhosis and carcinoma.

Fatty liver is not distinguished by pain. "The organ," writes Dr. Murchison, "can be freely manipulated with impunity; although, in extreme cases, the patient may complain of a feeling of weight or distension in the abdomen, increased by turning on the left side."[1] Reference has been made, incidentally, to a peculiar condition of the integuments observed by Dr. Addison, and believed by him to be pathognomonic of fatty degeneration of the liver. "Having," writes Dr. Addison, "in the course of my experience been often struck with a remarkable appearance of the face in certain patients—an appearance depending not so much on the expression of the countenance as the texture and aspect of the integuments—and having observed the exact resemblance of the appearance in each case, I endeavored to connect it with some corresponding uniformity in the accompanying disease; and at length arrived at the conclusion that, *when strongly marked it is indicative, if not pathognomonic, of fatty degeneration of the liver.* It is purely integumental, as it is not confined to the face, but may pervade the whole body; although I am disposed to think that it is earliest observable, as well as most conspicuous, in the integuments of the face and backs of the hands. To the eye, the skin presents a bloodless, almost semi-transparent, and waxy appearance: when this is associated with mere pallor, it is not very unlike fine polished ivory; but when combined with a more sallow tinge, as is now and then the case, it more resembles a common wax model. To the

[1] Op. cit. p. 45.

touch, the general integuments, for the most part, feel smooth, loose, and often flabby; whilst in some well-marked cases all its natural asperities would appear to be obliterated, and it becomes so exquisitely smooth and soft as to convey a sensation resembling that on handling a piece of the softest satin."[1]

In a considerable proportion of cases of fatty degeneration of the liver there will be observed a tendency, more or less marked, to fatty disease in other organs and tissues of the body; and this consideration is of importance in diagnosis. If, for example, in connection with such enlargement of the liver as is suggestive of fatty degeneration, there be present a feeble condition of the heart and pulse, a tendency to dyspnœa and to transient attacks of vertigo, and syncope, and perhaps to the existence of an arcus senilis, the probability is that the heart participates with the liver in fatty degeneration.

The urine is, generally speaking, not characteristically affected in fatty liver. Should it be secreted in diminished quantity, contain albumen in greater or less amount, and deposit a sediment in which oil-casts are discovered on microscopical examination, and should a tendency to general dropsy be likewise in existence, the inference to be drawn from these circumstances is that the kidneys are also involved in the fatty transformation.

It is also to be borne in mind that the fatty degeneration of the liver is, like fatty degeneration of the heart, apt to occur in persons who manifest a tendency to take on fat. Those who lead indolent lives, partake of a too full diet, and particularly indulge freely in alcoholic drinks, are most apt to suffer.

We also look for the occurrence of fatty liver in the phthisical and the sufferers from tubercular disease in all its forms.

Treatment. — This will, of course, vary according to the nature of the circumstances under which the diseased condition has occurred. With a fair prospect of being serviceable, it will be adopted in those cases in which the increased amount of fat in the liver is due to a faulty arrangement of diet, provided the patients possess sufficient moral courage, and the requisite restraint, to give the required treatment fair play. By such persons, fats, starchy articles of food, sugar, malt liquors, and indeed all spirituous liquors, must be avoided; while the lighter kinds of animal food, free from fat, green vegetables, and fruits are taken. Exercise in the open air, adapted to the strength of the individual, is to be enjoined. In prescribing a diet and regimen suitable for the removal of the fat-accumulation in the liver, great caution must be exercised, however, if there be at the same time reason to apprehend the existence of fatty degeneration of the heart.

Alkaline remedies, the alkaline carbonates or compounds of the alkalies with vegetable acids, have been found most serviceable in controlling and removing the dyspeptic symptoms so frequently associated with the liver enlargement.

The preparations of iron are required when decided failure of strength and anæmia are apparent.

The waters of Karlsbad, Marienbad, Homburg, and Kissingen, and those of Eger in Bohemia and Ems, when a tendency to diarrhœa prevails, are recommended, in decided forms of the disease, by Frerichs.

Occurring in connection with phthisis or other tubercular disease, the fatty condition of the liver does not demand any special modification of treatment, except that cod-liver oil and oil-inunction cannot then be regarded as suitable remedies.

The most fatty livers, as well as the largest organs, which have fallen under the writer's observation, have been in cases of chronic phthisis attended by extreme emaciation, in which cod-liver oil, either in large or moderate amount, had been daily consumed for a period of many months.

[1] A Collection of the published Writings of the late Thomas Addison, M.D., New Sydenham Society, p. 101.

CANCER OF THE LIVER.

By J. Warburton Begbie, M.D., F.R.C.P.E.

Malignant disease or Cancer of the Liver is of frequent occurrence. So much so is this the case as to justify the statement of Dr. Walshe, that "if primary and secondary cancer be taken together, it may be affirmed that no organ in the body becomes so frequently cancerous as the liver.[1] The two most frequent of the organic diseases of the liver are cirrhosis and cancer, and of these two the latter is in all probability the more so.

It is within a comparatively recent period that Cancer of the Liver has been accurately distinguished and defined. Formerly the disease was regarded as a consequence of hepatitis, or inflammation of the liver, and known under the name of Scirrhus. Morgagni applied the term "Steatomata," and also the expression "Hard Tumors," to cancerous masses in the liver substance.[2] Dr. Matthew Baillie, the well-known author of the "Morbid Anatomy,"[3] employed the term "Large White Tubercles" in reference to the same masses, while incorrectly estimating their nature; and even Portal,[4] after the time when Cancer of the Liver had been recognized and fairly described by Bayle, does not mention cancer as a peculiar form of liver disease, but merely as one of the results of hepatitis. It is to the author just named, G. L. Bayle,[5] that the merit is due of having been the first to give an accurate description of Cancer of the Liver, as well as to insist on the frequency of its occurrence. Bayle was the earliest to demonstrate the uniform essential nature of those bodies or masses which had, antecedently to his time, been indifferently designated hard tumors, steatomata, tubercles, and white bodies, and also scirrhus, and to point out that in anatomical structure these resembled cancer of the mamma, while in the changes they underwent, and in the effects they seemed to originate in the constitution of those who presented them, they were in all important particulars similar to cancerous growths in other organs and tissues of the body. In addition to the names already mentioned, there was another, under which cancerous growths affecting the liver were long known, namely Tubera. This was first suggested by Dr. Farre; and English writers have generally followed him in using the expressions Tubera Circumscripta and Tubera Diffusa.[1] Nor are these terms to be rejected as inappropriate; on the contrary, they indicate, what is very generally observed in regard to hepatic cancer, either that isolated cancerous nodules are found in the structure of the organ, or that portions more or less extensive of the hepatic tissue are infiltrated with cancer. It is in the same way and for like reason that French writers speak of "Tubercules Cancéreux" and "Tumeurs Cancéreuses Disséminées."

Cancer of the Liver is either *primary* or *secondary*. In the former case the disease is often limited to the liver, and, except to contiguous structures and organs, rarely spreads much further. The peritoneum covering the liver, the diaphragm, duodenum, stomach, and pancreas are apt in this way to become involved. The lymphatics also suffer, and through the lymphatic vessels the disease is conducted to deep-seated glands in various parts of the body. It is not a common event for hepatic cancer to propagate itself through the veins, but secondary cancer of the lung, usually taking the form of sparsely disseminated nodules, is thus occasionally caused.

Secondary Cancer of the Liver, in the majority of instances in which it occurs, succeeds the manifestation of the disease in some other part of the portal system—most frequently the stomach, but sometimes also the intestinal canal, the pancreas, and even the spleen. It is thus produced either through the contaminated

[1] The Nature and Treatment of Cancer, p. 324.

[2] De Sedibus et Causis Morborum per Anatomen indagatis, Epistola 38.

[3] Morbid Anatomy, p. 231. 5th edition, 1818.

[4] Observations sur la Nature et le Traitement des Maladies du Foie.

[5] Dictionnaire des Sciences Médicales; Cancer.

[1] "It is with extreme reluctance and diffidence," writes Dr. Farre, "that the author ventures to propose another name for this disease, but the epithets *large white* are not characteristic, being common to both species, and belong, indeed, in a more remarkable degree, to species 11."—Morbid Anatomy of the Liver, p. 4.

portal blood, or through the medium of the lymphatic vessels. Cancer of the Liver may, however, result from cancerous disease in many other parts of the system. It is secondary in not a few instances to cancer of the mamma, and in such circumstances is usually associated with pulmonary cancer as well. Hepatic cancer also supervenes on the primary cancer of the uterus, ovaries, testicles, bones, skin, kidneys, and lungs. Frerichs has summed up his own observations, and those of other writers, on this head with the following results. In ninety-one cases of hepatic cancer forty-six, or one-half, were associated with carcinoma of those organs whose venous blood flows to the liver; and of these, thirty-four were cases of cancer of the stomach. Besides, among the ninety-one cases there were twenty-three instances of carcinoma in other organs, which were evidently primary, so that only twenty-two cases remain in which the liver was the organ primarily diseased. Of all the instances of hepatic cancer, then, the disease was primary in the liver in nearly one-fourth, and in three-fourths it was of a secondary nature.[1] Rokitansky acknowledges four varieties of Carcinoma of the Liver:—1. *Areolar Cancer;* 2. *Carcinoma fasciculatum sive hyalinum* (Müller); 3, 4. *Medullary Carcinoma*, which occurs either as (*a*) *detached masses*, or as (*b*) *infiltration of the hepatic parenchyma.*[2]

By Frerichs, hepatic cancer is said in general to present the characters of ordinary *simple cancer*, and according to the predominance of the fibrous element, or of the cancer juice, to belong either to the well-known *Scirrhous* or *Medullary* varieties of the disease. Other forms occasionally are met with—for example, the *Carcinoma Melanodes*, where black pigment abounds; and the *Carcinoma Telangiectodes*, where the cancerous structure is rich in bloodvessels. Nor are these the only rare or exceptional varieties of hepatic cancer which are to be met with: tumors closely resembling sarcomatous growths (*Sarcoma*), *Cystic* and *Colloid* cancers, have been observed.[1]

Accepting the description which Frerichs has given of hepatic cancer, as at once the simplest and truest to nature, we shall now proceed to offer an account of the isolated and infiltrated forms of the disease, and in doing so shall adhere very closely to the statements of the writer just named.[2]

The isolated nodules of cancer seated in the liver vary in size from that of a millet-seed to that of an apple, or even of a child's head. In form they are for the most part roundish, but may appear flattened and even umbilicated ("nabelartig") when they extend to the outer peritoneal covering. The latter is in such circumstances opaque and thickened. There may be only one such nodule, or they may be numerous, scattered through the liver substance in its depth as well as on its surface. When large in size, the nodules are likely to be few in number. Further, they are most numerous when the hepatic cancer is secondary to new formations of a similar kind in other organs; and when themselves of primary formation, they are on the other hand more likely to remain isolated. Often, when a large cancerous tumor exists, numerous smaller ones of more recent origin are also found.

The substance of hepatic cancer is generally of a lardaceous consistence ("speckartiger Consistenz"); the mass is with far less frequency hard or gristly, and sometimes, on the contrary, it is soft, brain-like, almost fluctuating. On section, the surface of ordinary hepatic carcinoma presents a dull white color, over which are visible a greater or less number of red points and streaks, according to the amount of vascularity in the mass. On pressure a milky juice is yielded, and this is always most abundant when the cancer is soft or of medullary consistence. When the cancer juice has been expressed, the network of fibres entering into the formation of the cancerous tissue is readily distinguishable. Surrounding the cancer nodules there is seldom any distinct capsule: ordinarily the new formation passes in an imperceptible manner into the surrounding liver substance. This, as well as the relation of the elements in the parenchyma of the organ to the carcinoma, is most satisfactorily determined by examining with a high magnifying power thin slices of the tumor. So doing, it is found that, in most instances, the morbid process has its commencement in the interlobular connective tissue. Important

[1] Klinik der Leberkrankheiten, Band ii. S. 292.

[2] Dr. Walshe remarks, in regard to the varieties of cancer affecting the liver, as follows: "Encephaloid occurs in the liver in the pure cerebriform state, and in the solanoid and hæmatoid varieties: Scirrhus, especially in the chondroid and napiform varieties: I have never seen Colloid in this organ. The scirrho-encephaloid combination is of the most frequent occurrence: next follows the solanoid variety. Fibriform stroma abounds in the scirrhous nodule. Punctiform deposition of melanic pigment is rather common: a singular shining appearance, resembling that of black granite, is thus produced in certain tumors; in others, the hue is uniformly and deeply black."—Op cit. p. 325.

[1] A Manual of Pathological Anatomy, Sydenham Society's Edition, vol. ii. p. 151.

[2] Op. cit. Band ii. S. 273.

changes occur in the bloodvessels of the affected parts simultaneously with the disposition of cancerous matter in the liver substance. Just as the interlobular tissue increases, the branches of the hepatic artery become more marked, while those of the portal vein decrease. Of the latter, only isolated branches reach the cancerous mass, but of arteries, large branches pass through the fibrous framework of the cancer. Wherever the hepatic cells have given place to the cancerous elements, there is the disappearance of the capillary network formed by the portal and hepatic veins, which pertains to the normal structure of the liver, and a new vascular apparatus of abnormal arrangement is formed by the branches of the hepatic artery. There is great variety in the number of these vessels: in the milk-white tumor they are few in number, but sometimes, and more especially in soft cancers, they are sufficiently numerous to give a dark-red color to the new formation. The walls of these vessels are for the most part thin, like the walls of capillary vessels; hence they are readily ruptured, and hemorrhages occur. Such are usually limited to the cancer substance, but occasionally blood, owing to the giving way of the liver capsule, passes into the peritoneum. The apoplectic extravasation in liver carcinoma undergoes subsequent changes in color, which do not however differ from those which are observed under similar circumstances in other parenchymatous tissues. When the hemorrhages are on an extensive scale, a remarkable increase in volume occurs, and there is also sometimes anæmia produced. Sudden death from the very copiousness of the hemorrhage may be produced when, in cases of liver cancer, the capsule of the organ is ruptured. Frerichs insists on the importance of greater attention being paid to the changes which after a length of time are produced in the vascular apparatus of the liver, more particularly in the progress of fatty degeneration and softening. He believes it probable that the vessels in the cancerous depositions participate in various forms of retrograde metamorphosis. The larger branches of the portal vein, which are originally present in the liver affected by cancer, sometimes remain for a lengthened period uncontaminated, passing through the tumor, their channel free and walls healthy. This is not always the case, for not unfrequently they become filled up and obstructed by cancerous material. Cancer of the portal vein ordinarily originates from cancerous deposition in the liver; this affects the walls of the vein, and extends from without inwards. The wall of the affected vessels becomes thickened, degenerates, and sends growths attached by a broad or narrow base into the interior of the vein, so as either partially or wholly to occlude it. Sometimes a branch of the portal vein undergoes degeneration all round in a ring-like form, and becomes obliterated by a cancerous mass closing it up. The cancer, extending from the seat of the disease in the liver structure, passes along the channel of the vein, and by degrees fills up its branches down to its capillary terminations. Thromboses more or less extensive result from cancer of the portal vein; the tumors growing from the walls of the vessel burst through its lining membrane, occasioning hemorrhage and thrombosis. Thus, too, obstructed circulation is determined. Cancer of the portal vein is not, however, always produced in the way now described—namely, by cancer growing from the liver into the vessel. Cases are on record in which simple venous thrombi were found to contain the elements of cancer, and in which therefore the cancer cells must have been developed in the thrombi themselves. Frerichs, Cruveilhier, and Schröder van der Kolk have all noticed the remarkable circumstance of the branches of the hepatic veins usually remaining free from cancerous infiltration.

Besides the portal vein, the lymphatic vessels, ducts, and glands are liable to be affected in Cancer of the Liver. Those of the latter lying in the fissure of the organ are specially apt to be involved, often to such an extent as to compress the bile-ducts, and obstruct the passage of bile to the duodenum, thus occasioning jaundice. Frerichs describes various changes as occurring in the bile-ducts. Large ducts not unfrequently pass unaltered through the surrounding cancerous mass. The smaller ducts are more liable to compression, and disappear just as the liver cells themselves disappear. In the hepatic and cystic ducts it is not uncommon to find cancerous nodules beneath the mucous membrane, which also lead to interruption of the bile current. When cancer exists near the surface of the liver, it is usual to find the peritoneal covering involved in the disease—a thickened condition of the peritoneum, the result of limited peritonitis, is very frequently noticed. The diaphragm and right pleura may become implicated through extension of cancer from the convex surface of the liver.

As regards the rapidity of growth of hepatic cancer, there exists very considerable variety. Soft cancers may rapidly attain increase, while scirrhous growths enlarge very slowly. On this point Dr. Walshe observes: "The enlargement of tumors in this organ (the liver) sometimes takes place with extreme rapidity, from day to day almost; whether they be primary or consecutive, a manifest increase

of bulk may be detected." And again: "The duration of hepatic cancer varies extremely. There are instances in which it runs a slow and latent course for years; others in which it assumes much of the character of an acute affection."[1]

Dr. Farre, in relating a case of remarkably rapid growth, observes: "A surgeon who first examined the region of the liver on the 18th of April, and again about ten days afterwards, gave it as his opinion that the liver in that short period had acquired an addition equal to at least five pounds."[2]

Changes indicative of retrograde metamorphosis and decay occur in hepatic cancer just as in the same form of disease situated in other organs and tissues of the body. These changes, according to Frerichs, consist in fatty degeneration of the carcinoma as well as in its atrophy and shrivelling-up. The cells lying in the meshes of the fibrous stroma become filled with oil-globules, and present a white opaque appearance; in this way the cancer structure assumes a reticulated aspect, or, owing to the atrophy of large groups of cells, nodular-like masses are originated. Ultimately the fatty cells may become disintegrated, and, as a consequence, an emulsive fluid may be formed, which gradually undergoes absorption. These changes occur chiefly in the central portions of the morbid growths, and the fibres of the reticulated stroma where they take place are densely aggregated, the meshes becoming smaller, until there remains only a firm cicatrized tissue, yielding on pressure no cancer juice. Dr. Hughes Bennett, after a careful examination of the preparations illustrative of the healing process of Cancer of the Liver, as described by Professor Bochdalek of Prague, concludes, "It is very probable, therefore, that cancer may undergo transformations, sometimes fatty, and at other times calcareous; that its power of growth and re-development may be checked, and as a consequence it shrivels up, some of the softer parts are absorbed, and the remainder continues inert in the system, while the contraction of the surrounding parts, and the filamentous stroma of the cancer together, constitute the puckerings and cicatrices occasionally found as evidences of a spontaneous cure."[3] The same author has still more strongly expressed his belief in the spontaneous cure of cancer. He remarks (page 215), "The facts recorded in the first part of the work, I think, afford unequivocal proof that a cancerous growth may undergo spontaneous cure; and I feel persuaded that when evidences of this result are more diligently sought after than they have hitherto been, it will be found to have occurred much more frequently than is generally supposed." Frerichs, on the other hand, doubts the conclusion to which their observations have led Bochdalek, Oppolzer, and Hughes Bennett, regarding the retrograde metamorphosis already described as by no means significant of actual cure in cancerous disease;[1] and he has offered the very important suggestion that Oppolzer and Bochdalek may have confounded carcinoma with the syphilitic cicatrices of the liver, the nature of which is now much better understood than formerly. In defending his position, Frerichs has also stated that, although the retrograde change may be distinguished in the centre of the cancerous nodule, a progressive development of disease is observed at the circumference; and from this he concludes that the morbid action has not expired, but is only locally destroyed.

Reference has already been made to the varieties of hepatic cancer, the *scirrhous* and *medullary* having been signalized as the two most common in their occurrence. It is to these that the preceding description applies. Besides the scirrhous and medullary, Frerichs has especially indicated the four following varieties: 1. Fungus Hæmatodes. 2. Melanotic Cancer. 3. Cystic Cancer. 4. Alveolar, or Colloid Cancer. A few remarks may now be made regarding these, in the order named.

1. *Fungus Hæmatodes.* To this form of cancer, abounding as it does in bloodvessels, the term "Carcinoma Telangiectodes" is also applied. The vessels themselves are of large size, and possess thin walls; they are therefore readily torn, and extravasations of blood are occasioned. Instances of this peculiar form of disease are rare; but there exists a still rarer variety included under the head Fungus, in which certain portions of the cancer consist of creatile tissue. Plate IV. in Dr. Farre's work[2] is illustrative of the fungous character of the "Tubera Diffusa," Fig. II. being a representation of "the external and internal appearances of the tubera in their different stages, and the ultimate is shown by the largest tuber, which had destroyed the peritoneal tissue of the liver, and protruded in the form of a bleeding fungus."

2. *Melanotic Cancer.* This variety of hepatic cancer is characterized by the dissemination through the liver substance

[1] Op. cit. p. 328.
[2] Op. cit. p. 28.
[3] On Cancerous and Cancroid Growths, p. 212.

[1] Frerichs emphatically observes: Einen Fall von wahrer Heilung des Leberkrebses habe ich weder am Krankenbette, noch am Leichentische, jemals constatiren können."—Op. cit. p. 283.
[2] Op. cit. p. 52.

of small nodules, presenting in part a pale, and in part a yellow, brown, or black pigmentation.[1] The observation of Dr. Walshe, as to the "rather common" occurrence of punctiform deposition of melanic pigment, has already been referred to. Both Walshe and Frerichs describe the appearance of the liver so affected as in some instances resembling that of granite.[2] The pigmentary deposit takes place, generally speaking, in the interior of the cancer cells, but is also found in the form of isolated or aggregated granules in the cancer juice. Melanotic cancer tends to grow rapidly.[3]

3. *Cystic Cancer.* Under the name of Carcinoma Cysticum ("der Cystenkrebs") Frerichs describes a form of Cancer of the Liver characterized by the presence of round holes, from the size of a pea to that of a walnut, filled with a clear serous fluid, and lined by a smooth membrane, resembling a serous membrane. These are found in the cancerous nodules. Not unfrequently, the border of the hole is indistinct, and the serous membrane absent, while the contents, instead of being clear, consist of a slimy, viscid fluid.

4. *Colloid or Alveolar Cancer.* This is, unquestionably, a very rare form of hepatic cancer. Dr. Budd remarks, "Every variety of cancer, excepting, perhaps, gelatiniform, or colloid cancer, has been met with in this organ."[4] Dr. Walshe writes, "I have never seen colloid in this organ."[5] Nevertheless, colloid of the liver is occasionally met with. Frerichs has found it once, and Van der Byl, in the "Transactions of the Pathological Society of London,"[6] has recorded another instance.

Symptomatology. — Cancer of the Liver, whether occurring in its ordinary condition of scirrhous and medullary, or in one of the rarer forms now briefly alluded to, occasions an increase in the size of the organ. That increase is sometimes very great. A cancerous liver has been known to weigh fifteen pounds. The greater part of the abdominal cavity may be occupied by a liver thus affected. The enlargement takes place progressively, and often, particularly in the softer forms of the disease, with rapidity. It is of importance, however, to keep in view that, although augmented size is characteristic of hepatic cancer, the enlargement may be so slight as to escape detection during life. The organ may originally have been a small one, and the presence of cancerous deposition may not have caused it to project beyond the ribs, or a distended bowel may have overlapped the lower margin. Dr. Murchison refers to an instance of this kind, in which, unexpectedly, the presence of large cancerous nodules was found on post-mortem examination.[1] The enlargement is very generally irregular, owing to the presence of nodular excrescences. These, when well marked, as they often are, greatly facilitate diagnosis. They are to be felt by the hand over the surface of the enlarged organ, or at its lower margin, and not uncommonly in the advanced stages of the disease, when the patient is greatly emaciated, they are readily recognized by sight. So notable is the irregularity of the enlarged cancerous liver, that in some instances the tumor affects one portion of the organ only. Dr. Bright has recorded a remarkable example of malignant tumor confined entirely to the left lobe of the liver, and ascending towards the thorax.[2] It was situated in the left hypochondriac region, and originated within the left lobe of the liver, which pushed the stomach to the right side. The tumor within the liver was of the size of an adult's head, and of a rounded form; its external surface was firmly adherent to portions of the lower surface of the diaphragm, and posteriorly to the spleen and kidney. On cutting into the tumor, it was found to be of a fungoid nature (fungus hæmatodes), originating within the structure of the left lobe of the liver: internally, it was in some parts rather soft, of a dark red color, resembling a clot of extravasated blood; whilst in others its structure was of a pale color, resembling cerebriform cancer. In other places, the surface of the liver presented a hobnailed appearance: it also contained a small portion of fat."

The enlargement of the liver determined by cancer is essentially painful. The patient complains of great uneasiness, and when pressure over the enlarged organ is

[1] The color of melanotic tumors of the liver varies, according to the quantity of pigment granules they contain. In the same liver, tumors may sometimes be found of every shade, from light brown to black. Budd, Diseases of the Liver, p. 301.

[2] "Das organ erhält dadurch ein granitähnliches Aussehen." Frerichs.

[3] Medullary cancer not unfrequently occurs in the liver in the shape of cancer melanodes (melanosis), and equally as an infiltration, or in circumscribed masses. Rokitansky, op. cit. vol. ii. p. 154.

[4] Op. cit. p. 391.

[5] Op. cit. p. 325.

[6] Vol. ix.

[1] Clinical Lectures on Diseases of the Liver, p. 188.

[2] Clinical Memoirs on Abdominal Tumors and Intumescence, New Sydenham Society, Case 10, p. 260. There are other instances of a similar nature recorded in Dr. Bright's Reports, also in Andral's Clinique Médicale; and Dr. Murchison, op. cit. p. 188, refers to one which had fallen under his own observation.

made, the tenderness and pain experienced are apt to be great, the latter radiating in the direction of the shoulders and back. Jaundice is a variable symptom in hepatic cancer, and it is perhaps more frequently absent than present. When jaundice has once appeared in a case of Cancer of the Liver, it never disappears. Dr. Walshe remarks, "Jaundice, without ascites, occurs in somewhat less than half the cases, and, so far as I have observed, only appears under the influence of pressure directly exercised on the large biliary ducts; it is hence often connected with infiltration of the lesser omentum."[1] That jaundice is generally produced by the direct compression of the bile-duct by a cancerous nodule in the liver, or by enlarged glands in the portal fissure (Murchison), is no doubt true; and it is equally true that, without such pressure, the whole secreting tissue of the liver may be destroyed, and no jaundice result; but instances have been recorded in which no such obstruction has existed, and no appreciable lesion of the bile-ducts has been detected. Andral more especially has detailed such cases.[2] Ascites, like jaundice, is a variable symptom in Cancer of the Liver; probably it occurs a little more frequently than jaundice, although Dr. Walshe states the relative frequency otherwise.[3] Frerichs, in eighteen out of thirty-one cases, found a large accumulation of fluid ("grössere Mengen von Fluidum") in the peritoneal sac; in five of these the fluid was clear serum, in eight sero-fibrinous, in four bloody, and in one pure blood. In sixty instances recorded by different authors, and referred to by Frerichs ascites existed in thirty, in nineteen it was absent, and in the remaining eleven there is no notice of its existence or absence taken. Nearly all observers are agreed in attributing the ascites, for the most part, to an affection of the peritoneum, or chronic peritonitis, which commences over the liver surface. Frerichs styles this the usual cause. Dr. Murchison remarks: "The fluid may be a simple dropsical collection, due to compression or obstruction with cancerous matter of the trunk or large branches of the portal vein, but the amount is usually small as compared with what is observed in cirrhosis. Oftener it is the result of a chronic peritonitis originating on the surface of the liver." Dr. Walshe observes that, "When slight in amount, the accumulation of fluid appears to result from peritoneal irritation; when abundant, from pressure of the large venous trunks." The amount of fluid is generally not large, but occasionally it does become very great; and sometimes the rapidity of its collection is remarkable, notably exceeding the rapidity with which ascitic fluid gathers in cases of cirrhosis, a lesion much more frequently occasioning abdominal dropsy than hepatic cancer does. Hydræmia cannot be said to determine the ascites, but it probably favors the operation of the true causes, which are those now referred to. Œdema of the dependent portions of the body bears to Cancer of the Liver no fixed or definite relationship, but it is not unfrequently observed in the advanced stages of some cases, these especially characterized by the existence of the tumid belly with considerable or great ascites. Where very decided obstruction to the portal circulation exists—and this, as already stated, is exceptional as compared with cirrhosis—the superficial abdominal veins are apt to become enlarged and turgid, as is so commonly noticed in the latter form of hepatic disease. Enlargement of the spleen, so marked a feature in cirrhosis, and in some other diseases of the liver, is of infrequent occurrence in cancer. Of ninety-one cases referred to by Frerichs, splenic tumor ex-

[1] Frerichs remarks regarding jundice: "As a symptom of carcinoma of the liver, jaundice is of little value: in the majority of cases it does not exist; it was only present in thirteen out of thirty-one falling under my own observation, and in twenty-six out of sixty noticed by other physicians. Thus, fifty-two out of ninety-six cases did not present this symptom."

[2] Clinique Médicale; Maladies de l'Abdomen, Quatrième Partie, p. 274. The thirty-fifth observation, more particularly, is one in point. "Cancer du foie et de la rate. Tumeur douloureuse dans l'hypocondre droit. Ictère. Pas d'ascite. Ramollissement de la membrane muqueuse gastrique. Couleur ardoisée du duodenum." In giving an account of the post-mortem appearances in this case, Andral observes, "Aucune lesion appréciable ne fut trouvée dans les canaux hépatique, cholédoque et cystique, non plus que dans la vésicule: celle-ci contenait, au lieu de bile liquide, plusieurs petits calculs unis entre eux par du mucus."

[3] "Ascites without jaundice is a much less frequent consequence of the disease. Jaundice and ascites combined occur in a fourth or fifth of all cases; in about a third of the whole number neither of these symptoms is present. Either of them may be the sole existing symptom of hepatic disease: jaundice, however, as just signified, much more frequently than ascites." Op. cit. p. 329. The possible explanation of the different opinions expressed by different writers respecting the occurrence of jaundice in cancer of the liver depends on the circumstance that some may have only considered jaundice to exist when its presence was notable—as declared by a yellow color of the surface of the body, bile pigment in the urine, and clay-colored stools; whereas the simple coloring of the conjunctivæ, with a doubtful yellow tint of the cutaneous surface, may have been considered jaundice by others.

sted only in twelve; in all the others the organ was either normal in size, or smaller than usual.

The urine in Cancer of the Liver will vary, accordingly as jaundice is or is not present. In the former case, bile pigment will impart its own peculiar tint to the secretion. Notably, however, the urine in Cancer of the Liver is scanty and loaded with pigment. In no other form of hepatic or of pulmonary disease, with which the carmine or vermilion-colored deposit of urates is so intimately associated, has the writer had occasion to notice such large and persistent presence of these deposits as in certain instances of hepatic cancer.[1] But, while the diminished secretion and high coloration of the urine distinguish all cases of hepatic cancer at an early stage, and many cases throughout their entire progress, it is also noticeable that, when the patient has become much exhausted by pain, insufficient nourishment, and it may be by diarrhœa or hemorrhage, the urine ceases to present the febrile character, and acquires the anæmic ("urine anémique" of Becquerel). This has been noticed by Dr. Walshe,[2] and is also referred to by Dr. Parkes.[3]

In the early stages of the disease, the symptoms which usually present themselves are those of depraved digestion, anorexia, nausea, vomiting, constipation, and flatulent distension, with eructations of gas, which is often fetid. To these succeed pain in the region of the liver, frequently a short dry cough, and an irregular condition of the bowels, the constipation alternating with diarrhœa. Many of the more prominent symptoms of hepatic cancer are those also of cancer of the stomach, and it need hardly be remarked, that the former are always greatly aggravated by the coexistence of the latter disease.

As the disease advances, and the enlargement of the liver becomes extreme, uneasiness in the præcordia, dyspnœa, and disturbed action of the heart are apt to be induced. The emaciation resulting from this disease is frequently excessive, and more or less attenuation is the ordinary condition of the sufferers from hepatic cancer in its advanced stages. Exceptions to this rule have, however, been noticed. Frerichs and Oppolzer have observed cases of medullary cancer attended by no emaciation; the patients, on the contrary, presenting a plump appearance ("wohlgenährt"). Sudden death may occur, owing to the rupture of a cancerous tumor into the cavity of the peritoneum, or from perforation of the diaphragm (Cruveilhier). An attack of acute peritonitis, or of pleurisy, resulting from the irritation, or from the actual extension to these membranes of the cancerous disease, may, on the other hand, swiftly terminate life. Still more common, however, is it for the sufferer from hepatic cancer to perish gradually, the termination being that of the cachectic condition into which he has lapsed, from the entire failure of the digestive and assimilating functions.

There exists unquestionably variety in the duration of hepatic cancer. The disease generally, although not invariably, runs a rapid course. The progress of medullary carcinoma is swifter than that of scirrhus. A period from a few weeks to a few months, rarely exceeding twelve months, probably includes the duration of this mortal malady in whatever form it occurs, and the mean duration of it may, with equal probability, be fixed at six months. Dr. Budd, Dr. Walshe, and Frerichs, it is true, assign a longer period to scirrhus: Dr. Budd stating that "life may be prolonged to a year and a half or two years;" Dr. Walshe remarking that "there are instances in which it runs a slow and almost latent course for years;" and Frerichs, that "the disease may last for years:" but it is nevertheless true, that Cancer of the Liver is a disease which runs a rapid course, and that the following observation of Dr. Murchison is justified by extended observation and experience: "The very fact of an enlargement of the liver having lasted much longer (than a twelvemonth) would be an argument against its being due to cancer."[1]

ETIOLOGICAL CONSIDERATIONS.—The influence of *age* is important. Primary Cancer of the Liver is extremely rare before adult age. It may be said to occur more frequently between the ages of fifty and seventy. Two-thirds of the total number of deaths from hepatic cancer take place between fifty and seventy (Walshe). Of eighty other cases, includ-

[1] Becquerel, in treating of the urine in Cancer of the Liver, observes, "Un des effets les plus remarquables des maladies organiques du foie est de produire les urines febriles au plus haut degré: quantité peu considérable, forte coloration, forte densité, sédiments abondants, rougeâtre et briquetés d'acide urique." Séméiotique des Urines, p. 415.

[2] Op. cit. pp. 117 and 330.

[3] "Sometimes, and especially in the last stages, the urine is copious. pale, and deficient in urea. This has evidently depended, in my cases, in great measure on the utter failure of digestive and nutritive power. In a woman with enormous hepatic cancer and profuse diarrhœa, A. Vogel found the urine very copious, with little pigment, &c.; in each twenty-four hours there were only 122 grains of urea." The Composition of the Urine, p. 330

[1] Op. cit. p. 192.

ing thirty-one observed by Frerichs himself, and fifty-two recorded by other authors, there occurred seven between twenty and thirty years of age, fourteen between thirty and forty, forty-one between forty and sixty, nineteen between sixty and seventy, and two above seventy, or nearly one-half between forty and sixty. In twenty-nine cases recorded by Van der Byl ("Transactions of Pathological Society of London," vol. ix.), the mean age of the males (thirteen in number) was forty-one, and that of the females (sixteen in number) fifty. The youngest individuals affected with hepatic cancer, who have fallen under the observation of Frerichs, were a young man and young woman, of twenty and twenty-two years of age respectively. In both, the disease was secondary: in the former, there had existed medullary fungus of the testes; in the latter, cancer of the eyeball, on account of which it had been extirpated. Very much younger subjects than those of Frerichs's sufferers from secondary cancer of the liver have been observed. Farre, for example, records in detail the following cases: 1. A boy of two years and seven months had an enlarged testicle, which proved to be cancerous, and to which tumors of the liver and of the lung succeeded. 2. An infant three months old had a tumor originating behind the peritoneum, and enveloping the left kidney, to which Cancer of the Liver was secondary. 3. A boy, two years and six months old, had a tumor at the outlet of the pelvis, near the anus, and to this tubera of the liver succeeded, while the alimentary canal, the mesenteric glands, the thoracic duct, kidneys, spleen, and pancreas remained unaffected.[1] Persons of the most advanced age sometimes become the victims of Cancer of the Liver (Walshe, Budd).

Sex, in all probability, exerts little or no influence as a predisposing cause of hepatic cancer. Of one hundred and sixty-five cases, collected from different authors, the writer finds eighty-five to have been females, and eighty males. Dr. Walshe's statement would imply that males are more commonly affected than females.

Dr. Budd's assertion, that "we have no evidence that Cancer of the Liver is more frequent in hot climates than in our own, or in persons who drink spirits to excess, than in those who abstain from them," is amply confirmed by the experience of other writers. The hereditary transmission of cancer is almost universally admitted, but sufficient data do not exist for determining whether or not Cancer of the Liver depends in any notable degree upon hereditary taint.

[1] Op. cit. p. 38.

DIAGNOSIS.—Although under ordinary circumstances, the recognition of Cancer of the Liver is by no means difficult, yet cases every now and then do present themselves, in which the diagnosis is rendered far from easy. When, as usually happens, after the disease has existed for some time, the liver is enlarged in size, and the prominences on its surface can be distinguished on palpation, there is probably no form of organic malady which can be more readily or certainly diagnosed. But, as has already been stated, the liver may be the seat of cancer, without any enlargement having occurred, and in such circumstances we can only be led to a limited extent towards correct diagnosis from noticing the emaciation of the patient, together with the symptoms of indigestion, which are, at all events, likely to be present. Frerichs has observed, that in similar instances the invariable tenderness which the patient experiences when percussion over the liver is practised, the commencing ascites, and the absence of any other cause for the cachectic condition, will afford grounds for the suspicion that Cancer of the Liver exists, although, he adds, a certain opinion in such circumstances is not possible.

It behooves us also to bear in remembrance that, at its commencement and during its early progress, great obscurity surrounds the diagnosis, inasmuch as the decided enlargement and the prominent tubera of the surface, the only unquestionable indications of cancer, mark an advanced stage of the disease.

There are, moreover, certain other forms of hepatic disease, and certain diseases of neighboring organs, which may be mistaken for cancer, and with which, on the other hand, cancer may be confounded. Frerichs refers to ten such. These are, in the order named by him: 1. Waxy liver.[1] 2. Syphilitic hepatitis. 3. Liver depressed from habit of tight lacing ("Schnürleber"). 4. Hydatid disease of liver. 5. Hepatic abscesses. 6. Dilatation of the bile-ducts and gall bladder, resulting from stoppage of the hepatic and choledic ducts. 7. Cancer of the omentum. 8. Cancer of the stomach. 9. Cancer of the right kidney. 10. Accumulation of feculent masses in the transverse colon. To these ten another may be added, namely, the cirrhotic liver, when great distension of the peritoneum, by ascitic fluid, wholly prevents the reliable determination of the size of the

[1] It is especially in the cases of combined waxy liver and cirrhosis ("der cirrhotischen Wachsleber") that the diagnosis is apt to be difficult. A nodular surface exists in both this form of disease and cancer, but the nodules in the former case are much smaller than they are in carcinoma.

liver. No doubt, the increased dimensions of the liver in the case of carcinoma, even when accompanied by very considerable ascites, are, generally speaking, to be readily enough ascertained, but from time to time examples occur of cachectic-looking patients, who have passed the meridian of life, have become much emaciated, have slight jaundice, tenderness over the hepatic region, possibly no splenic enlargement, and urine which is equally characteristic of cancer and cirrhosis. In such it is a matter of great difficulty, without having recourse to paracentesis abdominis, to determine the real nature of the disease; and it is certainly necessary to be very cautious in reaching a diagnosis, for in precisely such circumstances the most careful and observant physicians have fallen into error. It seems unnecessary to enter into any detailed account of the salient points in the differential diagnosis between cancer on the one hand and the various diseases which have now been named; these are all signalized in the separate description of the affections themselves.

Prognosis.—Cancer of the Liver is a uniformly fatal disorder; the prognosis therefore, when once an accurate diagnosis has been formed, is necessarily of the worst possible description. It has already been stated, that a certain variety exists in respect to the rapidity with which the disease advances in different cases—the scirrhous cancer being, as a general rule, less speedy than the medullary. A knowledge of this well-ascertained circumstance should be permitted to modify the opinion as to duration of the disease which the physician may be called upon to express.

Treatment.—The only opportunity afforded is in the way of palliative treatment; for the relief, or it may be the removal, of various distressing symptoms, something at least may be done. The rule "ne nimia diligentia" is applicable to cases of Cancer of the Liver, supposing an accurate diagnosis of the disease to have been made. Anything like active treatment is wholly inadmissible. Mercury, which has for so long a time been invariably prescribed in disorders of the liver, can, in this disease, only do harm, and has been known to hurry on, with great rapidity, the occurrence of the fatal event. Frerichs expresses himself in nearly similar terms in regard to the use of iodine, arsenic, and the Karlsbad waters. It is true that Dr. Walshe has stated that the progress of the affection has appeared to have been stayed by the liberal inunction of the iodide of lead ointment over the hepatic region, and the internal administration of liquor potassæ in infusion of taraxacum.

It may be affirmed, without any fear of contradiction, that the great objects for the physician to keep in view, in the treatment of cases of hepatic cancer, are fourfold:—1. To support the patient's strength by the due administration of suitable food. 2. The promotion of digestion. 3. The relief of pain: and lastly, The procuring of refreshing sleep.

Diet must be light, and at the same time nutritious; nitrogenized much more than carbonized. Saccharine, oily, and starchy substances are to be avoided, as calculated to throw increased duty on the liver; and on the other hand, the lean of animal food, and carefully prepared soups, with well-boiled green vegetables, are to be administered. Food should be taken in small quantities and frequently, rather than in larger amount and after rarer intervals. Alcoholic stimulants, which, sooner or later, will be required, ought always to be given freely diluted with water, and in as moderate doses as possible.

There are various remedies, which the exigencies of each individual case will suggest, for the relief of the frequently disturbing and often very annoying dyspeptic symptoms which are associated with hepatic cancer. Of antacids, bismuth and magnesia are the chief; while for the alleviation of sickness and vomiting, in the former, with or without a little hydrocyanic acid, in the acid itself, and in ice, we find the most reliable remedies. Belloc's charcoal is an invaluable adjuvant when flatulence and its attendant distension exist; and for the same purpose Dr. Murchison suggests from fifteen to thirty minims of a saturated aqueous solution of carbolic acid with a few drops of chloric ether in peppermint water. Gentle laxative enemata should be regularly employed for the relief of the bowels, and this means is to be considered as decidedly preferable to the use of any laxative medicine, unless of the mildest description, by the mouth. The writer has found the phosphate of soda, either introduced into such articles of diet as soup, or simply dissolved in tepid water, to be a safe and, generally speaking, certain laxative. He can also recommend the use, under similar circumstances, of Kurella's powder, the pulvis glycyrrhizæ compositus of the Prussian Pharmacopœia, in one or two drachm doses, mixed with water or treacle.

As anodynes and hypnotics there are, of course, many remedies available, but it may be confidently affirmed that in no disease is the soothing influence of opium, in one or other of its various preparations, more frequently called for, and in

none do these apparently act with greater advantage and with fewer drawbacks than in the painful diseases of the liver, and perhaps chiefly in cancer of this organ. It is unnecessary to specify the different forms of the drug which may be employed, seeing that one preparation acts best at one time, and another preparation at another, even in the same case. It is a good rule, however, to begin with the administration of as small a dose as is consistent with securing the desired soothing or anodyne impression.

With an excessive increase of the ascites, as sometimes occurs, the breathing is rendered very difficult, and it may be necessary to perform paracentesis. This operation should only be had recourse to when the dyspnœa has become urgent, as it is rarely, if ever, succeeded by more than merely temporary relief, while, on the other hand, the reaccumulation of fluid in the peritoneal cavity occurs with increased rapidity after its performance, and the strength of the patient also rapidly deteriorates. When fluid has collected to any extent, it is very seldom reabsorbed; and on this account the employment of drastic purgatives, which are often useful in the treatment of ascites dependent on other causes, is in this disease to be avoided.

HYDATID DISEASE OF THE LIVER.

By J. Warburton Begbie, M.D., F.R.C.P.E.

The term hydatid (ὑδατίς, a vesicle, from ὕδωρ, water) was employed by some of the ancient physicians; and the authors referred to, although unaware of its real nature, were evidently familiar with a form of disease of the liver closely resembling that which is now known under the name of Hydatids. Hippocrates, for example, has the following: "Ὁκόσοισι δ' ἂν τὸ ἧπαρ ὕδατος πλησθὲν ἐς τὸ ἐπίπλοον ῥαγῇ, τούτοισι ἡ κοιλίη ὕδατος ἐμπίπλαται καὶ ἀποθνήσκουσι:"[1] and Aretæus, in describing the different forms of dropsy, relates that "Small and numerous bladders, full of fluid ("κύστιες σμικραὶ, συχναὶ, πλήρεες ὑγροῦ"), are contained in the place where ascites is found; but they also float in a copious fluid. . . . . It is said, however, that in certain cases such bladders have come out by the bowels."[2] Many observers in the sixteenth and seventeenth centuries have recorded facts which indicate their acquaintance with hydatid tumors of the liver. Christophorus de Vega,[3] who flourished about the middle of the earlier century, remarks: "Vidimus sæpe jecur, non in nobis tantum sed in animalibus occisis, plenum aqua, quoniam in membrana ipsum obvolvente continetur, plures efficiens vesiculas: hæ quoque rumpuntur." And Felix Plater, the earliest nosologist, whose works were first published at the commencement of the seventeenth century, observes: "Vesiculas tenuissimas pellucidas aqua distentas, pomi magnitudinem nonnunquam æquantes, hepatis substantiæ accrevisse, in cachecticis sæpe inveni: sed similes ex hepati et liene simiæ . . . excepi."[1] In the Sepulchretum of Bonetus (lib. iii. sect. xxi.) a case is recorded by Riverius, the interest of which is increased by the satisfactory nature of the cure: "Rusticus quidam hydropicus factus abscessum passus est in dextra parte abdominis; eoque aperto, infinitus prope modum vesicularum aqua repletarum numerus egressus est, ut ducentorum numerum excederet, idque per plurium dierum spatium, et sic omnino curatus est." Besides these there were many other observations made; but, notwithstanding this circumstance, the real nature of the hydatid tumor remained for a lengthened period unrecognized. To use the words of Davaine:[2] "Mais aucun des auteurs ou des observateurs antérieurs à Pallas (1766, 1767) ne soupçonna que ces vésicules jouissent d'une vie indépendante." Before Pallas wrote in 1760

[1] ΑΦΟΡΙΣΜΟΙ'. ΤΜΗ ΜΑ ΕΒΔΟΜΟΝ. Α. νί.

[2] ΧΡΟΝΙΩΝ ΠΑΘΩΝ. ΒΙΒΛ'. Β.

[3] Cristophorus de Vega. Opera omina. Leon. 1586.

[1] Felix Pater. Praxis Medica. Basil, 1602–4.

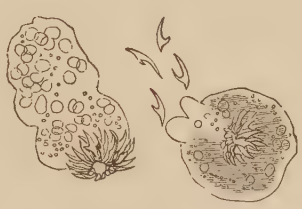
[2] Traité des Entozoaires: Paris, 1860. For a full account of the literature of the whole subject the reader is referred to this work of Davaine. Frerichs renders the historical *résumé* of Davaine only scant justice when he remarks, "Eine ziemlich vollständige Zusammenstellung des vorhandenen klinischen Materials lieferte C. Davaine in seinem vortrefflichen Traité."

("De infestivis Viventibus intra Viventia." East in Thesaur. Dissertationum medicarum, tom. i., Rotterod., 1768), the hydatid growths were supposed to be enlargements of the lymphatic vessels, while their mode of origin was variously explained; but this inquirer, having paid great attention to the constitution of the cysticercus, and having recognized the relations of the tænia with the hydatids, forthwith gave to the latter the name of Tænia hydatigena, thus establishing their parasitic nature. The observations of Pallas were made on the hydatids which were discovered in the livers of sheep and oxen. They were amply confirmed by Goeze[1] in 1782. Bremser, professor in Vienna in 1821, was the earliest to describe the human echinococcus. This he did by noticing in a hydatid cyst, of the size of a hen's egg, which had been removed by Kern from the subclavicular region in a female, thirty other hydatids, "the first of which exhibited to him the echinococci still living."[2] Very important discoveries in relation to hydatids have been made still more recently. The generally received opinion is, that the echinococcus is just a stage in the development of a tapeworm.[3]

[Fig. 69.

Invaginated Echinococcus.

Fig. 70.



Echinococci. (Gross.)]

Hydatid tumors are more common in the liver than in any other organ of the body. They consist of a sac, which is closely lined by a thin membranous cyst, and filled with a watery fluid. In the hydatid tumors which are found in man there are usually, indeed almost invariably, seen in the contained liquid a number, varying greatly in amount, of globular bladders or cysts similar to that lining the sac. These small cysts are of very different sizes, some being as small as a pea, while others exceed a walnut in size. It is to these bladders that the name of *Acephalocysts* (*a priv.*, κεφαλή the head, κύστις a bladder) was given by Laënnec.[1] In the majority of instances a single hydatid is developed in the liver, but this is not always the case, as two, three, and even more have been found. Sometimes with the presence of a single hydatid tumor in the liver there is associated a hydatid tumor of the right lung in its lower lobe, or sometimes both lungs are thus affected. More frequently still, hydatid disease of the liver and spleen coexist. Cruveilhier and Andral have recorded instances of this nature. In addition to these combinations, hydatid tumors of the liver have been found associated with similar disease affecting the mesentery, meso-colon, or omentum, likewise existing beneath the peritoneum, and occupying to a greater or less degree, sometimes so as nearly to fill up, the abdominal cavity. Cases 19 and 20 in Dr. Murchison's work[4] are instances of this nature, and others of a similar character are recorded by different writers.

It has not been satisfactorily ascertained how the development of the echinococci in different situations in the same person occurs. It has been suggested, 1st, that they owe their origin to the absorption of embryos at different periods of time, and, 2d, that the germs of the more recent cysts which are generated by the older hydatids are carried by the blood to other organs. Dr. Budd, who has discussed this subject at considerable length, and adduced many interesting cases from various writers, adopts the latter explanation, but at the same time is unable to reconcile one great difficulty which exists

[1] Frerichs describes the acephalocysts of Laënnec as hydatids containing no scolices ("welche keine Scoleces enthalten"), adding that the existence of such was for a long time doubted. More recently Küchenmeister has designated them sterile echinococci, and they have been considered as an earlier stage of development of the same entozoon by Van Beneden, Davaine, and Lassigne.

[1] Versuch einer Naturgeschichte, &c., 1782.

[2] Davaine, p. 353.

[3] The expression *echinococcus* (ἐχῖνος the hedgehog, κόκκος a grain or berry) was applied by Rudolphi to the entozoa of the hydatid cyst, from the cylinder of hooks, or hooklets, surrounding the head.

[4] Clinical Lectures on Diseases of the Liver, p. 109.

in the instance of hepatic and splenic hydatids, and thus expresses himself: "The greatest objection to the hypothesis here advanced to account for the tumors in the spleen and mesentery is, perhaps, the improbability that a hydatid germ should pass backwards in the branches of the portal vein, against the current of the blood. It seems more natural to suppose that if the tumors are related as cause and effect, the tumor in the liver is secondary to those of the spleen or mysentery, and not the origin of them. A strong fact against this latter hypothesis is the appearance of greater age in the tumor in the liver in such cases, and the circumstance that while hydatid tumors in the liver alone are not uncommon, it seldom, if indeed ever, happens that hydatid tumors exist alone in the spleen or in the mesentery."[1]

Whether single or multiple, the hydatid of the liver consists of an external firm fibrous capsule or cyst, of a whitish or yellowish color, adhering closely to the surrounding hepatic tissue, and plentifully supplied with branches from the hepatic artery and vena portæ.[2] Within this capsule, and completely filling it, there is a gelatinous translucent gray bladder, composed of numerous concentric hyaline strata. This is styled the mother-bladder of the echinococcus ("die sogenannte Mutterblase des Echinococcus," says Frerichs, whose description we are now following)—that is to say, the embryo, which has increased in size to a remarkable extent.[3] Within it is contained a clear watery fluid, with numerous large and small vesicles floating loosely in it, some of which, more particularly the smaller, are adherent to the mother-sac. Their size varies from millet or hirse seed to that of a goose-egg, while in number they may amount to many hundreds or even thousands. Boudet, Pemberton, Ploucquet, Riverius, and other writers are cited by Davaine and Frerichs as having recorded instances in which from five hundred and sixty to nine thousand hydatids were found in one cyst. The larger bladders sometimes contain smaller ones of a third generation, and in exceptional cases these in their turn others of a fourth generation. With the number and size of the daughter-bladders ("Tochterblasen"), and in relation to the amount of contained fluid, the dimensions of the mother-sac must necessarily increase; sometimes it reaches and even exceeds the size of a man's head. Rupture of the mother-sac may take place from over-distension, and then among the smaller cells only a few shreds of the former may be discovered. Upon the inner surface of the sac a number of delicate white particles may on a careful inspection be noticed; as a rule these are observed in groups, and may be seen from the outer aspect through the thin walls of the cyst. They are to be recognized in the fluid also, which is rendered slightly opaque by their presence. These are the scolices of the Tænia echinococcus in their various stages of development.[1] The animal is from one-twentieth to one-sixth of a line long, has a head which resembles that of the tænia, provided with four suckers ("Saugnäpfen"), and a trunk or proboscis ("Rüssel"), which is environed by a double crown of hooks, the number of which according to Küchenmeister ranges from twenty-eight to thirty-six, or from forty-six to fifty-two. The head of the worm is separated from its body by a furrow, and presents at its posterior extremity an umbilicated cavity, in which a cord is inserted, and through its means the attachment of the animal to the inner surface of the sac is effected. The body presents long stripes passing from the head backwards and also obliquely from side to side, in addition to which a greater or less number of rounded calcareous capsules are observed. The form of the animal varies greatly, according to the extension or retraction of the head.

As regards the chemical composition of the hydatid membranes Frerichs, while affirming that it has not as yet been sufficiently examined, refers to the proof he afforded in 1848 of their not consisting of some protein compound, as had previously been supposed. Lücke has rendered it probable that the hydatid membranes contain chitine,[2] and also that they yield grape-sugar when heated with sulphuric acid. Davaine speaks of the chemical composition of the hydatid membranes as being of little practical importance, but he proceeds to detail at some length that of the contained fluids.[3] The clear liquid from the hydatid cyst does not contain more than a mere trace of albumen; it is

[1] Diseases of the Liver, p. 443.

[2] This fibrous capsule is usually styled "Balg" by German writers, and "Kyste" by the French. It is the "Folliculous" of Malpighi, Wepfer, and Lancisi, and the "Hydatis externa" of Rudolphi.

[3] Klinik der Leberkrankheiten. Zweiter Band, S. 219.

[1] Scolices, from σκώληξ a worm. The term scolex is used to denote a stage in the development of certain worms, and among these the tænia.

[2] From χιτών a tunic or coat. Chitine was applied by Odier to a peculiar non-crystallizable organic substance discovered in the wing-sheath of the Cantharis, insoluble in water and alkalies, soluble in sulphuric and nitric acids, and becoming carbonized without change in form.

[3] Op. cit. p. 371.

charged with a considerable quantity of chloride of sodium, has a density from 1008 to 1013, and is either neutral or of slightly alkaline reaction. On the application of heat or addition of nitric acid no coagulation ensues. This is an important fact in relation to hydatid fluids, and may be of service in diagnosis.[1] Heintz and Bordeker have detected succinate of soda in the fluid, but Frerichs, Valentin, Recklinghausen, and Lücke have failed to discover its presence with any certainty.

Hydatid tumors are prone to undergo transformation. They become atheromatous, or they suppurate, and are found to contain either a considerable amount of pus, or of tubercular-looking material: of these the atheromatous degeneration is the really important change. Ruysch is referred to by various writers as having been the earliest to observe the transformation of hydatid growths. "Hydatides," remarked this distinguished professor at Amsterdam in the seventeenth century, "in atheromata, steatomata, et melicerides mutari nulla mihi ambigendi relinquitur ansa: plures enim hoc anno istius modi offendi hydatides, in quibus aliquando materiam pulti, lacti, sero, coagulo, caseoque æmulam reperi." Laënnec, Bremser, Cruveilhier, Charcot, and others have described similar changes. The atheromatous matter discovered in hydatid cysts is principally composed of phosphate of lime, and of an animal matter resembling albumen; it also contains a small quantity of carbonate of lime, of cholesterine, and other fatty matters. Davaine remarks that the presence of cholesterine in atheromatous hydatid cysts is in all probability of general occurrence. Besides the substances already mentioned, there are others less frequently found, and whose presence may be regarded as accidental. These are hematoidine and sugar. The former, so far as is yet known, is peculiar to hydatids of the liver.[2]

The position of the hydatid tumor or tumors is not limited to one part of the liver; on the contrary, such are discovered in the right as well as in the left lobe, on the upper surface equally with the under, deep in the substance of the organ, and again projecting from its surface and edges.[1] By the presence of such tumors the form of the liver is variously altered: its size may be greatly increased, so much so, indeed, as to fill the greater part of the abdominal cavity and reach upwards to nearly the right clavicle; but in its earlier stages there may exist a perceptible tumor at one part of the liver, not larger than an orange—this is the hydatid.[2] By the growth of the hydatid cyst or cysts, as the case may be, the glandular tissue of the liver becomes more and more compressed and atrophied. Those portions of the organ which are not primarily involved become thickened, and are said to present at times the characters of a true hypertrophy, the acini being enlarged and prominent, while no foreign elements are found. The larger bloodvessels and bile-ducts are rarely involved in the hydatid diseases; but to this notable exceptions occur, and these are referred to by Frerichs as follows: 1. The bile-ducts may become obliterated. Leroux in one case found no vestige of the hepatic duct, or cystic or ductus communis choledochus. Gadet de Gassicourt and many others have recorded instances of complete consumption of the common bile-duct. 2. Communication between the hydatid cyst and the bile-ducts may be established owing to the destructive pressure exerted by the former in its progress of growth, just as in the case of the bronchial tubes, and the intestinal canal, and large bloodvessels a passage is forced. Not infrequently the communication of a number of bile-ducts with the interior of hydatid cysts is found; and in this way it is that the contents of the latter become mixed with bile, and that death of the echinococci is caused. The presence of bile in the hydatid cyst would appear to prevent its further growth;[3] and Frerichs men-

[1] Redi was the earliest to point this out. Dodart asserted the correctness of Redi's observations in relation to hydatids in man, and Recamier first recognized this non-coagulability as an important diagnostic feature. (Davaine.)

[2] "Toutes les tumeurs hydatiques dans lesquelles, à notre connaissance, la présence de l'hématoïdine a été constautée, appartenaient au foie." (Davaine.)

[1] "The right lobe of the liver is the ordinary seat of the acephalocysts; the largest are always found at this part." (Rokitansky.) "The most common situation of hydatids of the liver is in its substance, and inclosed in a cyst; but they are occasionally attached to the outer surface of the liver, hanging from it, and occupying more or less of the general cavity of the abdomen." (Matthew Baillie, Morbid Anatomy, 1818, p. 239.)

[2] Murchison, p. 54.

[3] "The products of inflammation in the matrix, or of the parietes of other cavities (*e. g.*, the pleura), *the bile*, the intestinal secretions, &c., are particularly prone to induce a maceration and complete solution of the acephalocyst." (Rokitansky.) Cruveilhier long ago pointed out that bile appears to be fatal to the life of the parasite. Its presence may determine the commencement of a spontaneous cure, or may light up severe inflammatory

tions that in most cases of hydatid disease in which he has observed disintegration and shrinking, the sac has contained bile. Sometimes the hydatid bladders pass from the sac into the open mouths of the bile-ducts, and becoming impacted there occasion the dilatation of the ducts, and ultimately pass into the gall-bladder or the bowel. By the last-mentioned way the hydatids may be entirely removed, and the cyst cured. 3. The bloodvessels of the liver, and especially the hepatic veins, may, in a similar manner to the bile-ducts, communicate with the echinococcus cysts.

Reference has already been made to the changes which are prone to occur in hydatid tumors of the liver as their age advances. Owing to the increased thickness of the capsule, which at times amounts to a fibrous or cartilaginous consistence,[1] the development of the echinococci is seriously interfered with; not only so, but their death ensues from the impossibility of the obstruction being overcome. Thus it is that, as Cruveilhier pointed out, a spontaneous cure is effected. It is in the case of hydatid tumors of comparatively small size that the spontaneously favorable termination or cure is likely to occur. Dr. Murchison observes: "Unfortunately, this favorable result is confined for the most part to tumors of so small a size that they are not recognized during life. When the tumor is sufficiently large to give rise to symptoms and be diagnosed, such an event is so rare that it cannot be calculated on." Where nothing occurs to interfere with the growth of the hydatid and the development of the contained echinococci, the former may attain a very great size, and may come to exert very injurious pressure not only on the substance of the liver but on neighboring organs. Increasing gradually, it may be very slowly, it finally bursts, and the usual consequence of rupture is death more or less sudden. The directions in which a hydatid tumor of the liver may burst are various. Some of these entail certainly sudden death, others are a little less formidable. Davaine and Frerichs have both fully illustrated this subject. Dr. Murchison classifies the direction of perforation under the seven following heads: 1. Into the right pleural cavity or pulmonary tissue. 2. Into the pericardium. 3. Into the peritoneum. 4. Through the abdominal parietes or lower intercostal spaces. 5. Into the stomach or intestines. 6. Into the biliary passages. 7. Into the vena cava inferior. Of these the rupture into the cavity of the chest is the most frequent, and it occurs almost invariably on the right side. The consequence of the discharge of the contents of a hydatid tumor in the liver, through an opening in the diaphragm, into the pleura, or as in exceptional instances into the pericardium, is a very acute attack of pleurisy or pericarditis, as the case may be. When there exist adhesions between the base of the right lung and the diaphragm, there is formed a cavity of greater or less size in the pulmonary substance, and this cavity may either remain closed, or may ultimately communicate with the bronchial tubes. In this way the contents of the cyst may be expectorated; shreds, if not entire vesicles, are detected in the sputa, together with a watery fluid containing sugar, and sometimes also bile. A cure may thus be effected, but still more likely death through exhaustion will take place.[1] Rupture of hydatid tumor of the liver into the cavity of the peritoneum or into the stomach or intestines is of rarer occurrence than into the chest. As in the latter case pleurisy arises, so in the first-mentioned peritonitis, which being very violent is apt to prove swiftly fatal. Rupture in this case may be altogether spontaneous or the result of accident—a push, or fall, or strain, or blow. Opening into the stomach or intestinal canal is by no means so serious as rupture into the cavity of the peritoneum. In the latter case death assuredly takes place in a few hours, but sometimes the accident of rupture is survived for days.[2] Frerichs saw at Breslau a case in which a hydatid tumor of the liver had been ruptured by a fall: the subject of this case, a young lady, died within a quarter of an hour after the occurrence of the accident. On the other hand, Andral relates the case of a woman, twenty-seven years of age, who was admitted into the hospital La Charité, with all the symptoms of advanced pulmonary phthisis. Suddenly this woman was seized with severe abdominal pain, which

action, perhaps terminating fatally. In reference to this subject we find Davaine thus expressing himself: "Nous ajouterons que le contact de la bile a été considéré dans ces dernières années commes favorable à la guérison du kyste, et que l'injection de bile de bœuf, partiquée à plusieurs reprises dans un kyste hydatique du foie, n'a pas donné lieu à la formation de pus." (P. 479.)

[1] Frerichs remarks that he has seen a hydatid cyst of the size of a goose-egg completely surrounded on all sides by a calcareous shell from two or three lines thick.

[1] "A hydatid tumor of the liver may also open into the lung, the hydatids be spit up, and the patient recover. Two instances of this have fallen under my own observation." (Budd.)

[2] Dr. Budd observes: "It would seem that the bursting of a hydatid tumor into the sac of the peritoneum causes death as surely, and just as speedily, as the bursting of an abscess, or as perforation of the stomach or bowel." (Op. cit. p. 436.)

was greatly increased by the slightest pressure. During the four days which followed the occurrence of the pain the abdomen, previously pliant and insensible, became swollen, continuing at the same time very painful, the pulse acquired a great frequency, and became more and more feeble, and the greatest prostration ensued. Death occurred while the patient was in the act of vomiting green bile. At the post-mortem examination, on raising the liver, a solution of continuity, capable of admitting the extremities of three fingers united, was discovered a little to the right of the gall-bladder: this communicated with a large cavity filled with broken-down hydatids. A renewed examination led to the discovery of the débris of hydatid membranes swimming in the serous fluid within the peritoneum. There were traces of inflammation in the gastro-intestinal mucous membrane. Tubercles at different stages existed in the lungs.[1] The rupture of a hydatid cyst into the stomach or intestinal canal is generally effected through an opening which is narrow and small, and these characteristics it retains, the hydatids being evacuated slowly, and not infrequently at lengthened intervals.[2] Usually the discharge takes place from the bowels, and the hydatids or fragments of them are recognized in the stools; if the stomach has been opened, the hydatids may be vomited; this, however, is infrequent as compared with the discharge *per anum*. Sometimes the discharge takes place simultaneously in both directions. Again, but this is of rare occurrence, a hydatid tumor of the liver may open externally, through the abdominal parietes, or through the lower intercostal spaces. Dr. Murchison observes: "Of ten cases of this kind where a spontaneous opening occurred, and of which I have collected notes, five terminated fatally." The contents of the liver hydatid may be discharged at or in the vicinity of the umbilicus, or in one of the lower intercostal spaces, and recovery may take place. Frerichs and Davaine refer to an instance of this kind recorded by Felix Plater. It is to be held in remembrance that even after the discharge of the hydatid has taken place through the parietes, without causing extreme disturbance to the patient, all risk of dangerous consequences is not passed, for suppuration of the cyst may take place, and either fatal peritonitis or exhaustion occur. Those are exceptional cases only in which an opening into the vena cava ascendens occurs. When this accident occurs, the contents of the hydatid cyst, having reached the blood, are carried to the right side of the heart, and thence reach the pulmonary artery, in which, remaining impacted, they give rise to fatal asphyxia. Of this nature is a case related to Frerichs by Professor Luscha. A woman forty-five years of age had for a lengthened period a tumor in the region of the liver, which in no way interfered with her general health. One morning, while stooping in the act of dressing, she became suddenly collapsed, and was in a few minutes a corpse. At the examination of the body after death, the liver near its blunt edge was found to be the seat of an echinococcus cyst as large as a child's head. The sac surrounded the vena cava and was adherent to it. At the lower border of the fossa for the vena cava, the wall of the sac was only a line and a half thick, and here and there was an irregularly indented opening which communicated with the vena cava. Through this opening the bladder had passed to the right side of the heart, and into the pulmonary, the channel of which was completely obstructed.[1]

Another and the last mode of communication of the hydatid tumor in rupturing is with the biliary passages. Dr. Murchison remarks that "it is not uncommon for a communication to be established between a hydatid tumor of the liver and one of the bile-ducts." Davaine, under the head of "Action des Hydatides du Foie sur les Conduits et la Vésicule biliaires," gives several instructive cases of this communication. Case 10 in Dr.

[1] Andral, Clinique Médicale. Maladies de l'Abdomen; xliv. observation.

[2] "L'ouverture de communication qui se fait entre le kyste et l'estomac ou l'intestin est généralement assez étroite, et donne issue aux vésicules avec beaucoup de lenteur; celles-ci sont évacuées au dehors par intervalles plus ou moins éloignés et souvent pendant plusieurs mois." (Davaine.) The much greater danger of the opening into the stomach than into the bowels is well exhibited by the cases which Davaine has collected. Of eleven cases where a hydatid tumor appeared to open into the stomach, six were fatal, while of fifteen of which the opening apparently took place into the intestine only one proved fatal.

[1] Besides the exceedingly interesting case given above, there are other two instances of *hydatid embolism*, or occupation of the vascular system by foreign substances, having their origin in hydatid cysts, recorded at some length by Davaine, and more briefly by Frerichs. One of these occurred in the practice of Piorry, the other in that of Lhonneur. They are placed by Davaine under the head of "Hydatides, ou matières d'un kyste hydatique libres dans le cœur et les vaisseaux, et provenant d'un organe étranger au système circulatoire." Of the first of these it is remarked at the inspection of the body: "On retrouva une substance semblable (la matière puriforme?) dans la veine cave inférieure, dans le cœur droit, dans l'artère plumonaire et dans ses divisions." (P. 405.)

Murchison's work is a remarkably interesting one of hydatid tumor bursting into the bile-duct, with discharge of innumerable hydatid membranes *per anum*. In this case recovery took place. Subsequently, however, peritonitis, owing to rupture of old adhesions occurring during the act of vomiting, carried the patient off. Davaine also gives an instance of recovery on the authority of Dr. Perrin ("Tumeur dans la Région du Foie : Hydatides et Calculs biliaires rendu par les Selles"). These cases of recovery are certainly remarkable, for although without doubt the biliary canals may become so dilated as to afford a passage to the contents of a hydatid cyst from the liver to the bowel, such cases have almost always proved fatal. Rupture is, however, not the only source of danger in hydatid disease of the liver; there are other and various ways in which death may be induced by their growths. It may result from gradual exhaustion. This is likely to occur when from its great size important organs and functions are interfered with by the tumor, and more especially the respiration.

Again, reference has already been made to the occurrence of changes within the sac, and there are not a few instances in which death has resulted from suppuration or gangrene occurring either within the cyst itself, or external to it. A further source of danger in such circumstances is the establishment of pyæmia, and the formation of secondary purulent depositions. Lastly, secondary hydatid tumors may form in the liver or mesentery, and not only in the adjacent situations, but at a distance from the primary disease.

Case 21 in Dr. Murchison's work is one of secondary hydatid tumor in the spinal canal. Similar instances are on record in which the brain and the heart have been the seats of secondary hydatid tumors.

Symptomatology.—One of the most notable features in connection with this subject is the fact that hydatid tumors of the liver may occur and attain very considerable size without their existence ever having been suspected. There is in some instances an entire latency of symptoms.[1] When the tumor is developed deep in the substance of the liver, and when it never attains any considerable dimensions, this is more apt to be the case, for the simple reason that under such circumstances neither pain nor any particular functional derangements are apt to occur. But generally speaking the presence of hydatid growths in the liver is proclaimed by very manifest symptoms. The liver becomes enlarged, and the enlargement continues till a projection more or less marked takes place into the abdominal or the thoracic cavities, in some instances in both directions. This enlargement can readily be determined by palpation and percussion. Unlike the other varieties of painless enlargement of the organ, the fatty and waxy more particularly, the enlargement is not uniform, but usually in one direction only, and thus the form of the liver is greatly altered. On palpation the tumor is free from irregularities of surface, has a smooth globular and elastic feeling, and not uncommonly a distinct sense of fluctuation is recognized. On percussion over the tumor there is felt not infrequently, but by no means invariably, a peculiar vibration or trembling, the so-called *hydatid vibration*. This sign, which was earliest noticed by Briançon and Piorry, is best produced by laying two or three fingers of the left hand gently but firmly over the tumor, and then striking these abruptly with the middle finger of the right hand, or, as Frerichs has observed, when, after percussing, the finger is allowed to rest for a moment on the pleximeter. Pain is not a necessary or other than an accidental symptom of hydatid disease of the liver, and its presence may, generally speaking, be regarded as indicative of inflammation having taken place in the sac. Exceptional instances, however, do occur in which violent pain is excited by every movement, and by manipulation of the tumor. Frerichs mentions an instance of this nature, in which the diagnosis of cancer was made. On making a puncture, a clear watery fluid escaped, and the pains ceased almost immediately after the tension was removed, and the withdrawal of the fluid permitted the return of the neighboring parts to their normal position. Jaundice is not a common symptom, neither is ascites or splenitic enlargement, nor are indications of disturbed digestion, apt to be notable or persistent. With the gradual growth of the tumor, however, there occur difficulty in breathing, a short dry cough, and palpitations of the heart, when the extension is towards the thorax; irritability of the stomach, vomiting, and a confined state of the bowels, when the abdominal organs are subjected to pressure. Œdema of the feet and a varicose state of the veins in the legs, with hemorrhoidal fulness, occur when the tumor causes pressure on the vena cava. The function of the kidneys is rarely interfered with in hydatid disease of the liver. Instances are, however, on record in which the kidney has become involved through the extension of the disease. Hooklets of the echinococcus have been discovered in the urine, and even portions of the hydatid

[1] "Les hydatides pouvent naître dans le foie, s'y développer, et acquérir un volume considérable sans donner lieu à aucune espéce de symptomes." (Andral.)

cyst have been met with.[1] Dr. Murchison relates an interesting case in which the urine contained large quantities of pus, owing to the pressure of a large hydatid tumor of the liver inducing pyelitis.[2] The general health is little if at all interfered with, there is no pyrexia, and only when the enlargement has attained very considerable development, and mechanical obstructions are its necessary result, is there any evidence of impaired nutrition; then and not till then does loss of flesh take place, and is the aspect of cachexia acquired.

This disease, slow in progress, may last many years. A sudden death may occur from rupture, or the same event happening under better auspices as regards the situation of the opening may determine a complete recovery. Frerichs mentions a case which fell under his own observation, in which the disease had existed for at least seven years; and others, the earlier symptoms of which had been noticed two or three years previously. Dr. Budd refers to the case (related in the *Edinburgh Medical and Surgical Journal* for October, 1835) of a lady who died at the age of seventy-three. Two hydatid tumors, whose sacs were almost completely osseous, and which contained a thick gelatinous matter and numerous hydatids, were found in the liver. It appeared probable from the symptoms that the tumors had existed from the eighth year of her age.[3]

Diagnosis.—There are certain diseases with which hydatid tumor of the liver may be confounded: these are abscess and cancer of the liver, distension of the gall-bladder, aneurism of the aorta, pressing the liver forwards with communicated impulse, pleural effusion on the right side, and enlargement of the right kidney from cystic disease. The absence of acute symptoms and the tardy growth of the tumor will serve to distinguish hydatid disease from hepatic abscess. It is well to keep in remembrance, however, that hydatid tumors of the liver are subject to inflammation and suppuration; and when these have occurred, the usual constitutional and local symptoms of abscess are present. Dr. Murchison has especially called attention to this possible source of error in diagnosis, and has observed that the recognition of the real condition must depend entirely "on the patient's previous history; the fact of a painless tumor having preceded the symptoms of abscess, and the absence of exposure to the ordinary causes of tropical abscess."[1] The absence of smoothness of surface, increased density, and tenderness, usually distinguish cancer; and as that fatal disease advances, the unmistakable appearance of cachexia which the patient acquires is one never assumed by the sufferer from hydatid disease. Frerichs admits, however, that in the instance of large soft cancers of the liver, which offer a feeling of fluctuation on palpation, the diagnosis is by no means easy. Jaundice and attacks of colic almost invariably precede the distension, with enlargement of the gall-bladder, which may be mistaken for a hydatid tumor. Besides the probable absence of these symptoms in the latter case, there are the absence of hydatid vibrations and the situation of the tumor, which rarely corresponds exactly with that of the gall-bladder, to distinguish the two. Aortic aneurisms are the seat of very notable pulsations—often of bellows murmurs—and are generally accompanied by much pain: these circumstances, in addition to the different form of their outline, will assist in their recognition. Frerichs has expressed the opinion, founded on personal experience, that hydatids of the liver rising up into the thorax are not unlikely to be mistaken for pleuritic effusion. It is of much importance here to note, and accurately to mark, the character of the upper margin of dulness throughout its entire length. In the case of hydatid disease the line is arched upwards, and is at a lower level, close to the spine and sternum, than in the axilla; whereas in pleural effusions the superior line of dulness is almost invariably horizontal. Frerichs also observes that the heart is displaced further to the left and still more elevated, in the case of hydatid tumor, than is common in even large pleural effusions. Too great reliance must not, however, be placed on this indication. Where doubt still exists, the simple and safe plan long ago suggested by Recamier may be followed, namely, that of introducing, at the point of most marked fluctuation, a very fine exploring trocar. The fluid which escapes from a hydatid cyst is distinguished by its clear watery appearance, and, as already mentioned, by the absence of albumen. The fluid when the hydatids are dead may be turbid and whey-like, but in such circumstances some traces of broken-down echinococci will in all probability be found. Dr. Murchison relates

[1] Parkes on Urine, p. 213.

[2] Op. cit. p. 94.

[3] Barrier found that in twenty-four cases there were three in which the disease had lasted for at least two years; eight where it had continued from two to four: and four where it had existed from four to six years; while in single instances no fewer than fifteen, eighteen, twenty, or even thirty years, was the period of its continuance.

[1] Op. cit. p. 59.

a case where an enormous cystic tumor communicating with the pelvis of the right kidney, and existing for eight years, simulated hydatid tumor of the liver.[1]

Hydatid disease of the liver, when admitting of diagnosis, is to be regarded as a dangerous lesion. The prognosis can never be otherwise than most serious. Owing to the development of the tumor we have observed how contiguous structures and functions are liable to be interfered with and perverted, while the sudden rupture in various directions, which is to be dreaded, is apt to occasion either immediate or rapid death. It is, unfortunately, only in the smaller hydatid tumors—those not appreciable during life—that the favorable termination, owing to spontaneous death of the echinococci, is alone likely to occur.

Etiological Considerations.—The direct cause of hydatid growths in the liver of man is now thoroughly ascertained to depend on the introduction into the stomach and intestines of the ova or embryos of the Tænia echinococcus, which, passing into the liver, there undergo development. Of the fact thus stated there can be no longer any doubt; but as to the precise manner in which the transmission is accomplished there is still room for additional inquiry and research.[2] The Tænia echinococcus is a very small tapeworm inhabiting the intestinal canal of the dog, or perhaps more correctly speaking of the genus Canis, including therefore wolves and foxes.[3] This tapeworm, then, not longer than a quarter of an inch, and possessing only four joints, in the last of which, or proglottis, are contained the ova, is an entozoon of the dog chiefly; and its ova, being voided with the feces of the animal (whether dog or wolf or fox, but not pig as has been erroneously supposed), and becoming mixed with articles which are used for the food and drink of man, are with such carried into the human body. "It is easily understood," remarks Küchenmeister, "how dogs, particularly shepherds' and butchers' dogs, possibly also wolves, and foxes where, as in Iceland, these animals live on sheep, may come at this tænia. In those parts of the country where the breeding of sheep, cattle, and pigs flourishes, the already named animals of the dog race, and especially the shepherds' and butchers' dogs, are readily able to consume the bladders of this species of echinococcus; and we may hazard a conjecture as to the entrance of the eggs and six-hooked embryos into the human body, which can only be similar to that which we have pointed out regarding the origin of the *Cysticercus tenuicollis*, and to which a high degree of probability has been assigned through the experiments of Professor Haubner and myself."[1]

In the sheep as well as in man, the ova of the *Tænia echinococcus* develop hydatids. In the case of these animals the echinococci are liable to be set free during the act of slaughtering, and when the intestines are thrown out as offal they are consumed by dogs, to be in these animals once more developed into tapeworms. Dr. Thudichum observes that the hydatids of man most frequently accompany him to the grave, or are at all events not permitted to continue their dangerous existence; and while man does not add to the multiplication and dissemination of the echinococci, his own liability to the disease is maintained by the cycle of infection which subsists between dogs and sheep.[2]

These considerations have of course a very important bearing on the preventive treatment of hydatid disease of the liver. There are a few other particulars in relation to etiology which call for remark. Hydatids of the liver are chiefly met with about the middle period of life, and are certainly rare both in childhood and in old age. Dr. Budd observes, "Hydatid tumors are most common in persons from the age of twenty to that of forty, but may occur at any age from six years to fifty."[3] The youngest of Frerich's patients was seven, and the oldest sixty-five years of age; and by far the most of them were in the period of life between thirty and fifty. "Les hydatides existent

[1] Case xxiii. op. cit. p. 115.

[2] "Envisageant les causes de l'apparition des hydatides à un autre point de vue, on peut se demander pourquoi ces entozoaires siégent-ils ordinairement dans les organes abdominaux et thoraciques, frequence qui chez les moutons et les bœufs est extrêmement prédominante. Il a présenté de ce fait une explication plausible, s'il est vrai que les hydatides doivent leur origine à la transformation ou au développement d'un embrion de ténia. Cet embrion, introduit dans le tube digestif avec les aliments ou les boissons, et ne pouvant vivre ou se développer avant d'avoir subi certaines transformations, quitte cet organe en le perforant, et gagne les parties voisines, soit directement soit par l'intermédiare des vaisseaux sanguins, lesquels se rendent dans le foie ou dans les poumons." (Davaine, op. cit. p. 381.)

[3] Die in und an dem Körper des Leben den Menschen vorkommenden Parasiten, &c. &c. Bearbeitet von Dr. F. Küchenmeister. Erste Abtheilung, S. 150.

[1] Eodem loco, S. 151.

[2] See "Report on Parasitic Diseases in Quadrupeds used as Food," by Dr. Thudichum. Seventh Annual Report of Medical Officer of Privy Council. London: 1865. Also Murchison, op. cit. p. 72.

[3] Op. cit. p. 448.

principalement," remarks M. Davaine, "à l'âge moyen de la vie : c'est de vingt à quarante ans que les cas sont les plus communs. Elles sont presque inconnues chez les petits enfants."[1] Hydatid disease of the liver appears to be of nearly equal frequency in the two sexes. Frerichs and Davaine both notice the statement, resting chiefly on the high authority of Dr. Budd, that sailors enjoy a remarkable immunity from hydatids of the liver. For the rest, we are ignorant of any proclivity to the disease determined by particular occupations and employments. Dr. Budd asserts that "in this country hydatid tumors seem to be more frequent among the poor than among the rich ; a circumstance most probably attributable to the fact that the poor dwell in lower and worse-drained houses, and subsist on a diet which contains a much larger proportion of vegetable food."

Different countries appear to be differently affected by hydatid disease. It is endemic in Iceland, where a sixth part of the population suffers.[2] Frerichs, judging from his own experience, considers the disease more frequent in Breslau and Silesia than in Göttingen, Kiel, and Berlin ; while Virchow has found its greater prevalence at Wurzburg than in the Prussian capital. Dr. Budd points out that the medical writers of India are almost silent regarding it. On the authority of Dr. Shattuck, it is very rare in the United States. Leudet says that hydatids are more common at Rouen than at Paris. Hydatid disease is certainly very uncommon in Edinburgh ;[3] much more so than the interesting observations of Bright, Budd, Greenhow, Murchison, and others would lead us to believe it to be in London.

A very curious circumstance respecting hydatid growths in man, is that they have frequently been observed to develop themselves in parts of the body which have received some or another form of injury. Dr. Budd has especially noticed this, remarking, "Of the published cases of hydatids of the liver there is a considerable proportion in which the tumor seems to have formed soon after a blow on the side, and, as was supposed, in consequence of it." Several of the cases recorded by Frerichs had apparently an origin of this kind.

TREATMENT.—This may be briefly considered under the two heads of Preventive and Curative. A knowledge of the cause of hydatid disease of the liver is suggestive of its prophylaxis. To secure the latter, attention to the following rules is required : 1. Dogs should be prevented feeding on the offal of sheep and other animals infested with hydatids. Butchers, shepherds who kill for themselves, and slaughterers of horses, must be careful not to throw such offal to dogs as food. The duty devolves on the officer of health or physician, in a community where hydatid disease is liable to occur, of instructing the people, so as to show them, as Küchenmeister has expressed it, "the unintentional injustice" which may be done in this matter if, acting as pointed out, they favor the transmission of the eggs and embryos of the tænia. The same authority suggests that butchers, slaughter-house men, and shepherds should be instructed to destroy the bladders whenever they meet with them, either by burning them or by placing them in spirits ; and this course, he adds, might be observed under threat of punishment. Dr. Murchison wisely recommends that "dogs ought to be rigidly excluded from all slaughter-houses or knackeries, and dog's meat ought always to be thoroughly boiled." The same writer suggests that in order to destroy as far as possible the tape-worms generated in the dog, these animals should be periodically physicked, and their excreta buried in the ground or burnt.

The *curative* treatment is either medicinal or operative. Little can be said in favor of the former. It has indeed been supposed that certain medicines are capable of being removed from the blood into the hydatid cysts, and of their killing the echinococci. It was conceived by Baumes and others that calomel possessed this power. Laënnec prescribed chloride of sodium ; Hawkins iodide of potassium.

None of these remedies have ever effected a cure, and it is now well known that iodine does not reach the fluid of the hydatid cyst. Electricity has been employed in Iceland for the purpose of destroying the parasites, and with an apparently successful result. The most

[1] Davaine, p. 379.

[2] See "Reflexionen über die Entstehung der in Island endemischen Hydatiden krankheit, insofern dieselbe durch Echinococcen bedingt ist." (Küchenmeister, op. cit. S. 169.)

[3] "The acephalocyst, even in its usual site, the liver, would appear to be extremely uncommon in Edinburgh ; as among many thousand dissections which I have either performed or seen performed during my connection with the Royal Infirmary, there has not been a single instance of acephalocystic hydatid or echinococcus either in the liver or in any other organ, with the exception of this one." (Remarks on a Case of Hydatid Tumor in Upper Part of Right Lung, by Dr. Gairdner. Clinical Medicine, p. 431.)

"During six years in which he has acted as Pathologist in the Infirmary, and during other six or eight years over which his observation had extended, he had not previously met with a similar case." (Dr. Haldane, eod. loc. p. 436.)

important, however, of the means of cure is by *operative* interference; in other words, the evacuation of the fluid contents of the hydatid cyst by means of a fine trocar, and the subsequent closure of the opening. The operation of puncture was practised by Sir Benjamin Brodie, Dr. Bright, and others; while successful as well as unsuccessful cases in their hands resulted. Acute peritonitis and the entrance of air giving rise to suppuration within the cyst, are the dangers to be dreaded, but these have chiefly arisen in those cases where a larger opening than is necessary has been made.

Dr. Murchison and his colleagues in the Middlesex Hospital have satisfactorily shown that these dangers are in great measure avoided by using a very small trocar; and further, that the removal of the liquid from the cyst, which is as thin and limpid as water, is alone sufficient for the purpose of destroying the parent hydatid and its offspring. "The administration of chloroform before the operation," remarks Dr. Murchison, "is not advisable, as the pain is but momentary, and the vomiting sometimes induced by the chloroform interferes with that perfect rest of the parts which ought always to be insisted on for forty-eight hours after the puncture; but if the patient be young or nervous, it may be well to induce local anæsthesia by the ether-spray." The puncture is to be made at the point where the hydatid fluid appears to be nearest the surface, and every care taken to prevent the entrance of air. For the latter purpose it is advisable to remove the canula before the whole of the fluid has been withdrawn. When the canula has been removed, the opening should be covered with a piece of lint steeped in collodion, over which a compress and bandage are applied, and for two whole days the patient ought to be kept in the recumbent posture, and at perfect rest. It may be well to give an opiate at once, but its administration must not be delayed if the slightest pain is experienced. Formerly the puncture of a hydatid cyst was considered a very dangerous procedure unless adhesions of a firm character were in existence whereby the escape of the fluid into the pleural or peritoneal cavity was prevented (Frerichs). Now, however, the use of the fine trocar renders it unnecessary to wait for the formation of adhesions. The walls of the cyst are highly elastic, and the small opening closes immediately after the withdrawal of the instrument. Care should always be taken during the gradual removal of the canula to press the punctured portion of the abdominal wall against the cyst. Dr. Murchison, whose instructive account of the operation we have given, has furnished a table, in which are exhibited the particulars of forty-six cases reported by himself, Dr. Greenhow,[1] and other authors. In thirty-five of these the operation was successful; in ten it was followed by suppuration, necessitating a free opening. Of these ten cases, eight recovered and two died. In one case the patient died from acute peritonitis within twenty-four hours of the operation. When suppuration in the sac has occurred, a large permanent opening is the only justifiable mode of operative interference. The reader is referred to the details of cases furnished by Dr. Murchison and Dr. Greenhow, as affording abundant proof of the propriety of tapping by means of a fine trocar. It appears that the injection of water, solutions of iodine and of iodide of potassium, and bile, practised by various physicians, is quite unnecessary, and at no time free from increased danger.

WAXY LIVER.

By J. Warburton Begbie, M.D., F.R.C.P.E.

The expression Waxy is now almost universally understood to indicate a disease of the Liver attended by great enlargement; not resulting from, or having any intimate connection with, fatty degeneration of the organ, as was at one time supposed, but due to the presence in the liver of a peculiar substance, giving it a somewhat translucent appearance, resembling beeswax or Canada balsam, and which, whatever be its real nature, as yet undetermined, is readily distinguished from fat.

Rokitansky was the earliest to point out the essential characters of this form of disease, and the earliest also to indicate

[1] Pathological Transactions, vol. xviii.

the very important relation in which it stands to certain cachectic conditions and constitutional disorders: this he did in 1842.[1] Afterwards, through the careful observations of Dr. Gairdner in reference to the Kidney (1848), and of Dr. Handfield Jones and Dr. Sanders on the Spleen (1852), the peculiar morbid condition in question became more generally recognized. Since that time, our knowledge of waxy degeneration as affecting the liver, spleen, and kidneys, as well as other organs and tissues of the body, has been greatly advanced by the researches of Meckel, Virchow, Frerichs, and several other pathologists on the Continent, and by many observers also in our own country.

SYNONYMS. — Lardaceous, Baconlike, or Amyloid Liver; Scrofulous Enlargement of the Liver; Colloid Infiltration; Die Wachsartige; Speckige oder Amyloide Degeneration der Leber; Wachsleber; Die Speckleber.

ANATOMICAL DESCRIPTION.—The first character of the Waxy Liver to attract notice, is its size. Thus affected, the organ may become enormously enlarged. Dr. Murchison remarks: "I have known the liver of an adult affected with this disease weigh upwards of 180 instead of 50 or 60 ounces, and the liver of which I show you here a portion, weighed one-seventh, instead of a twenty-fifth of the entire body of the child from whom it was taken."[2] There is only one other form of disease of the liver, which is capable of determining a greater degree of enlargement than the Waxy, and that is the Cancerous. In the slighter degrees of the degeneration, the size of the liver may be little altered, it may even be diminished.[3] Besides increase in size there is augmented density, the organ becomes very heavy, acquiring a peculiar doughy firmness.[1] The capsule is smooth and tense, and the form of the liver little changed. The absence of any change in form must, however, be understood as applying to the liver affected by the purely waxy degeneration. When this is associated with fatty change, the edges are blunt and rounded; when combined with cirrhosis (granular induration), the surface is covered with large and small knobs; and finally, when cicatrices the result of syphilitic disease of the liver remain, there is the formation of irregular lobes, and these may be separated by deep fissures. A knowledge of these circumstances is of importance in the endeavor to form a correct diagnosis, for otherwise the enlargement of the liver, attended by irregularities of surface, might be taken for cancerous disease of the organ. The Waxy Liver, when the degeneration is well marked, presents a pale or fawn-colored aspect, or, owing to some degree of congestion, there may be a mottled appearance. When cut with a sharp knife, the section is smooth, dry, and firm, while little or no stain is communicated to the blade as in fatty liver.

Waxy disease of the liver has its commencement either in the secreting cells, or in the minute branches of the arteries of the organ.[3] The earliest noticeable change consists in the central portions of the acini, assuming a reddish-yellow color, becoming at the same time pellucid and firmer than natural, as well as sharply limited from the surrounding dull-gray edge, so that the lobular structure of the organ is very clearly marked. When solution of iodine is applied to the glistening pellucid spots, these become of a deep-red color, while the surrounding

[1] Rokitansky had himself used the term "waxy" in the sense of a variety of fatty liver, and as something different from the lardaceous (*speckig* or baconry liver) degeneration. "The waxy," he remarks, "is a variety of the fatty liver. It is distinguished from the latter by a color resembling that of beeswax, by its greater consistence, dryness, and brittleness; and these qualities depend upon a peculiar modification of the infiltrated fat, which, although accumulated to a considerable amount, leaves but few traces on the scalpel. (Pathological Anatomy, Sydenham Soc. Ed. vol. ii. p. 121.)

[2] Clinical Lectures on Diseases of the Liver, p. 23.

[3] "Unter 23 Fällen fand ich drei mit normalem, drei mit verkleinertem Umfang der Leber."—FRERICHS, *Klinik der Leberkrankheiten*, Zweiter Band, 167.

[1] "Die Consistenz von einer eigenthümlich teigichten Festigkeit."—FRERICHS.

[2] That the waxy degeneration has its commencement in the minute arteries of those organs and tissues which become affected by it, is now a well-established pathological doctrine. The first indication, probably, of the participation of the bloodvessels in waxy degeneration, was given by Dr. Gairdner; and among the earliest to make the discovery that, in the kidney, this morbid process has its *commencement* in the minute arteries and capillaries, was Dr. Kirk, the distinguished physician and naturalist, who accompanied Dr. Livingstone on the Zambesi Expedition, and who is now the British Consul at Zanzibar. (See an interesting historical sketch of waxy or amyloid degeneration in the Edinburgh Medical Journal for March, 1868.) Virchow observes: "Am schönsten kann man diese Veränderungen verfolgen an denjenigen Gebilden, welche überhaupt als der häufigste Sitz dieser Veränderung betrachtet werden müssen, nämlich an *den Kleinsten Arterien*."—*Die Cellularpathologie*, S. 335.

border is of a pale yellow. As the waxy degeneration becomes more marked, the appearances now described are seen to characterize the entire lobular structure; the lobules become larger, with ultimate obliteration of their borders, and the parenchyma of the gland offers a homogeneous, smooth yellowish-red, somewhat glassy surface, in which the open mouths of the bloodvessels are seen, and from these a little thin blood is found to be flowing. Portions of liver thus affected, resemble, according to Frerichs, whose description we have been closely following, delicate slices of smoked salmon.[1] When attention is paid to the progress of waxy degeneration in the individual cells, it is noticed that the fine granular contents of the normal cells by degrees disappear, and a homogeneous clear substance occupies their cavities. In a few cells the nucleus may still be recognized, swollen and lustrous; but in most the nucleus can no longer be detected. Cells thus degenerated are firmly connected to each other, and sometimes present solid masses in which neither cell, wall, nor areolar connective tissue can be distinguished. In advanced waxy degeneration angular fragments, resulting from the disintegration of the degenerated cells, are here and there to be met with.

Similar changes to those now described as occurring in the secreting elements of the gland take place in the smaller vessels, the walls of which become thickened, unbending, homogeneous, and lustrous, their channel being at the same time narrowed and not unfrequently entirely occluded; thus circumstanced, a vessel has the appearance of a colorless cylinder in which no fine structure can any longer be seen. Considering the peculiar vascular arrangement which exists in the liver, the question occurs, in which of the minute vessels are the changes now described discoverable? Acknowledging the difficulty of determining in every case to which system the affected vessels belong, Frerichs considers it an ascertained fact that generally it is the minute branches of the hepatic artery which are implicated. The morbid change, however, is not confined to them, for Frerichs and others have noticed the same in the portal and hepatic veins.[2] When the waxy degeneration has its seat in the liver cells, the bloodvessels, or connective tissue, a mahogany-red color is observed when the solution of iodine, as already stated, is brought in contact with the affected portion of the organ; and if a little sulphuric acid is cautiously applied to the surface already moistened by the iodine, the deep-red is converted into a dirty violet, or it may be a blue color. The latter reaction, however, is rare in the liver.[1]

Waxy degeneration of the liver is not unfrequently associated with fatty deposit in the organ, and also with cirrhosis. The important connection of waxy disease with syphilis, prepares us to meet with those cicatrices and gummy nodules, as well as irregular hepatic lobes which plainly indicate the previous occurrence of the constitutional disorder.

Etiological Considerations.—Waxy degeneration of the liver is more commonly met with in males than in females. Frerichs has collected sixty-eight cases, of which number twenty-three had fallen under his own observation; and of the sixty-eight, fifty-three occurred in males and only fifteen in females. Waxy degeneration affecting the liver appears to be of most frequent occurrence during the period of adolescence. In the sixty-eight instances referred to, Frerichs met with three under 10 years of age, nineteen between 10 and 20, nineteen between 20 and 30, eighteen between 30 and 50, and only nine between 50 and 70.

Reference has already been made to the important observation of Rokitansky, connecting the waxy degeneration of the liver with the previous existence of a depraved habit of body or cachexia.[2] Of this nature, there rank in the highest order of importance, diseases of the bones, caries and necrosis, and constitutional syphilis, also syphilis associated with mercurial cachexia. Dr. Graves had noticed the connection of "hypertrophy of the liver" with syphilis and abuse of mercury. After detailing the features of a case which had fallen under his observation, this distinguished writer proceeds: "Here, then, we have venereal, abuse of mercury, periostitic inflammation, abuse of mercury followed by exacerbation of the periostitis and establishment of mercurial cachexy; and the history of the case is wound up with hypertrophy of the liver. This was the first case in which I had observed this concatenation of dis-

[1] Op. cit. p. 167.

[2] "Ich sah inders auch mehrfach erkrankte Capillaren, welche der Lokalität nach der Pfortader und den Lebervenen anzugehören schienen."—Frerichs.

[1] "Im Allgemeinen sieht man die blaue Färbung der Wachsartigen Substanz in der Leber seltener."—Frerichs.

[2] "This affection," remarks Rokitansky, "is found concurrent with constitutional disease of the vegetative system, especially with scrofulous and rickety disease, with syphilitic and mercurial cachexia, and it may subsequently be congenital. It appears that it is occasionally developed as a sequela of intermittent fever in cachectic subjects."—Op. cit. vol. ii. p. 121.

eases; since that period I have seen a similar train of morbid phenomena twice in private practice, and once in hospital. First, we have abuse of mercury, then periostitic inflammation and mercurial cachexy, and the scene is closed by morbid enlargement of the liver. Now, I do not look upon this sequence as merely fortuitous. The diseased actions are, I think, related as cause and effect, and each successive condition is consequent on the previous one."[1] It will scarcely admit of doubt that the enlargement of the liver described in this passage by Dr. Graves, is identical with the waxy degeneration, and accordingly Dr. Budd is justified when he remarks that the fact of *enlargement* of the liver being apt to occur in persons whose health is broken down from the combined effects of mercury and syphilis, was first distinctly noticed by Dr. Graves.[2] Frerichs, however, believes that Waxy Liver has been incorrectly imputed to the use of mercury, and he enters a decided protest against the views of Graves and Budd, which attaches great importance to the mercury, asserting that he knows no case where an increase of size of the liver, and still less where a distinct waxy degeneration of the organ, has been caused by mercury. Next in order of importance to syphilis, ranks chronic purulent discharge, and especially such as is found in connection with disease of bone or joints.

The influence of intermittent fever in giving rise to waxy degeneration is doubtful, although Rokitansky places the latter as an occasional sequela of the former in cachectic subjects. Dr. Budd remarks that he has met with one instance in which severe and long-continued ague in a boy was followed by scrofulous disease of the glands of the neck and of the bones, and subsequently by great enlargement of the liver and ascites. This enlargement Dr. Budd ascribes to the scrofula and not to the ague, and he asserts that the liver very seldom gets much enlarged from ague, in this respect offering a notable contrast to the spleen.[3] The relation of tubercular disease of the lungs and the bowels to waxy degeneration of the liver is unquestionably far less intimate than that of fatty degeneration; nevertheless such relationship exists. Meckel pointed it out, and Wilks and Friedreich as well as Frerichs have noted it. Dr. Murchison mentions that of fifty-two persons dying from tubercle and whose autopsies he has recorded, the liver was fatty in twenty and waxy in six, and in three of the six there was likewise caries of the bones. In these fifty-two cases, however, the connection of tubercle with waxy degeneration was more remarkable than the occurrence of the latter in the liver alone appears to indicate, for Dr. Murchison further intimates that fourteen of the entire number had waxy disease of either the kidneys, the liver, or the spleen.

Besides the causes of waxy degeneration now mentioned, there are others which must be styled unknown causes, inasmuch as in certain cases the morbid condition of the liver in question—and the same remark applies to the degeneration in other organs—appears independently of any one of the already determined causes.

Pathology of Waxy Degeneration of the Liver.—This branch of the inquiry, in its intimate aspect, is still greatly involved in obscurity. The point of departure in the morbid process, the "primum mobile," is as yet undetermined. Frerichs speaks of two possible modes in which the causes we have already considered may operate: first, the degeneration may be due to deposition from the blood; or, second, the waxy substance may be developed in the part from some albuminous matter previously deposited. Virchow, who has devoted great attention to this subject, insists that the gradual infiltration of the parts in a waxy degeneration is with a substance brought to them from without. This view he holds to be greatly strengthened by the consideration that a whole series of organs is implicated, and that the morbid process is not confined to a single spot, but affects at the same time many parts of the body. The only place in which Virchow has observed waxy degeneration apparently independently developed, and not due to changes from without, is permanent cartilage. Although impressed with the belief that the waxy change is determined by deposition from the blood, neither Virchow nor any other observer has hitherto succeeded in detecting any distinct change in the blood.[1]

Symptomatology.—The enlargement of the liver, in addition to its being great—sometimes so great as to occupy a large portion of the abdomen—is uniform in all directions. The tumor thus formed is dense, firm, and resistant, and its surface is quite smooth. The lower border is usually rounded and free from irregularities. When cirrhosis and syphilitic affection of the liver coexist with waxy degeneration, irregularities of surface and a

[1] Clinical Medicine, Lecture xxx.

[2] Diseases of the Liver, p. 330.

[3] Op. cit. p. 331. The notion that the waxy material is dealkalized fibrine has been advanced, but this requires confirmation. (See Dickinson, Medico-Chirurgical Transactions, vol. l. p. 55.)

[1] Cellularpathologie, S. 339.

lobulated character will be acquired. There is seldom either pain or tenderness, and the patient feels little or no inconvenience from the free handling of the enlarged organ. The extreme size of the liver in waxy degeneration is far from being rapidly attained; on the contrary, many months, and often years, are passed during which a slow and gradual augmentation in its bulk is going on. Dropsy is not a symptom of waxy disease of the liver; therefore ascites, which is so notable a feature in certain hepatic affections, does not occur in it. Neither is jaundice at all frequently met with. Frerichs observed jaundice in two out of twenty-three cases, and in both of these the lymphatic glands in the fissure of the liver were found enlarged. A similar enlargement of the lymphatics, due to waxy degeneration in them, may, by pressure on the trunk of the portal vein, give rise to ascites. Splenic enlargement is of common occurrence, but, unlike the splenic tumor met with in cirrhosis and in cancer of the liver, it is due to waxy degeneration of the spleen, and not, as in these instances, to blood stasis in the organ from interrupted portal circulation. With waxy disease of the liver a similar degeneration of the kidney is frequently associated; and as the latter possesses distinctive characters of its own, it is of much importance to observe the condition of the urine when suspicion attaches to the liver. The urine then of waxy kidney is very generally increased in amount during the greater period of the disease, only becoming reduced in quantity towards its termination.[1] In color it is pale, in density moderately low (from 1015 to 1008), and it contains a considerable amount of albumen. Casts of the tubuli uriniferi are frequently absent from such urine, and when detected in it are usually of the hyaline character. Dr. Murchison remarks that he has never observed the amyloid reaction with iodine and sulphuric acid to be produced in these casts, but in exceptional cases has found the reaction in some of the cast-off renal cells.[2]

The writer has noticed a tendency to the occurrence of epistaxis, sometimes severe in character, to accompany the waxy degeneration when both liver and kidneys have participated in the disease; he has indeed come to regard waxy degeneration of the kidneys as the form of chronic renal disease with which nasal hemorrhage, pericarditis, and uræmia are most apt to occur. Where the liver is the seat of this transformation it is then of special importance, in a prognostic point of view, to determine whether or not the kidneys are likewise involved. Vomiting and diarrhœa are of by no means uncommon occurrence in connection with waxy liver, and for the most part depend on the existence of a similar degeneration affecting the blood-vessels, the villi, and sometimes even the tissue of the mucous membrane itself, of both stomach and intestines.[1] It is in

[1] Dr. Grainger Stewart, who has specially insisted on the polyuria of waxy degeneration of the kidneys, remarks: "I have never found it absent, except in cases accompanied with severe diarrhœa, or by inflammation of the tubules of the kidneys, or by a peculiar syphilitic deposit in the stroma of the organ."—*A Practical Treatise on Bright's Disease of the Kidneys*, p. 91.

[2] In addition to the characters mentioned above, the writer has been led to associate with the passage of an increased amount of pale, lemon-colored urine, the existence of a very peculiar odor of the breath and of the skin, which, for want of a better term, he has been accustomed to style musty odor. With this odor he has not only in several instances detected the coexistence of the special characters of the urine, dependent on waxy degeneration of the kidney, but has invariably noticed the presence of uroxanthin in greater or less amount. Not only so, but conformably to the experience of Heller, in regard to urines rich in his uroxanthin, the addition of an acid to a urine, or sometimes its continued exposure to the air, has led to the development of a blue color (indigo-blue, or uroglaucin), or of a notable red color (urrhodin, indigo-red). It may be conjectured that the pigment which thus finds its way into the urine is in all probability a product of the transformation of hæmatin. The anæmic appearance of the patient in the advanced stages of waxy kidney is certainly conspicuous. The writer desires to direct attention to the point now mentioned, and while abstaining from directly styling the odor of the breath and cutaneous surface, to which he has adverted, *indigoferous*, he must nevertheless confess that it has frequently struck him as having a pretty close resemblance to the smell which is emitted by musty indigo. On the subject of Indican, some interesting observations will be found in Dr. Parkes's treatise, "The Composition of the Urine," p. 196.

[1] "Die Schleimhaut von Magen und Darm findet man unter solchen Umständen gewöhnlich dem Anscheine nach wenig verändert, nur blass, durchscheinend und aufgelockert; bei genauerer Untersuchung ergeben sich indesswichtige Anomalien, besonders in den feineren arteriellen Gefässen, deren Wandungen wachsartig entarten, glänzend, rigide und dick werden, hier und da bis zum Verschluss ihres Lumens. Häufig findet man auch die Substanz der Zotten wachsartig infiltrirt oder es entsteht ein Schwund derselben, durch welchen sie über weite Strecken hin zerstört werden. Mitunter greift die Zerstorung auch auf das Gewebe der Schleimhaut selbst über; es bilden sich unregelmässige, bis in das submucose Gewebe eindringende Substanzverluste, an deren Rändern man zerfallende schleimhautfetzen bemerkt. Wieder-

this way that digestion and assimilation are so much interfered with in cases of Waxy Liver, and that the anæmia, which is so characteristic a feature of the disease, is in part at least produced.

Progress and Duration.—Waxy degeneration of the liver is essentially a chronic malady, often lasting for a very considerable period—during many months, and sometimes even years. It is, moreover, in the vast majority of cases a fatal disease, and the termination is for the most part due to a gradual process of exhaustion. Not very unfrequently an attack of pneumonia or dysentery, or some other form of abdominal inflammation of a low type, proves the immediate cause of death. Frerichs believes in the possibility of the recently infiltrated waxy substance being absorbed; and such being the case, it is conceivable that a permanent recovery in some cases may occur. What is of special importance, however, to observe is, that the mere fact of the enlargement of the liver being reduced under treatment does not imply recovery. The cachexia with which the enlargement is associated may be firmly seated, and, although a favorable change in the condition of the liver may occur, so firmly seated as gradually to lead to the thorough and complete undermining of the constitution and the inevitable fatal result.

Diagnosis.—From what has already been stated more particularly under the heads of Symptomatology and Etiology, it will be seen that the recognition of Waxy Liver and its distinction during the lifetime of the patient from other forms of hepatic disease, does not involve any special difficulty, at all events when the organ is notably increased in size. The prominent features in diagnosis are, the uniform enlargement and augmented consistence of the liver, with which increased size of the spleen, and very generally also albuminuria of the nature previously described, are associated. If, in addition to these prominent features, there be the tendency to vomiting and diarrhœa and a history of previous syphilis, or of disease of bone, particularly caries, or suppurations, or tubercular affections, the diagnosis may be made with tolerable certainty. Assuredly there is no other form of hepatic enlargement, neither the fatty liver, nor the simple hypertrophy, nor hyperæmic swelling, nor cancerous nor hydatid disease, which possessing the one similar character of increase in size, do not materially differ in other and these readily observed features.

Treatment.—Under this head it is first of all of importance to consider the preventive treatment of Waxy Liver; regarding which Dr. Murchison has truly observed that it has not yet received the attention which it deserves. We have noticed that waxy disease of the liver is apt to occur after long-continued suppuration occurring in any part of the body, and leading to exhausting discharges. It is of importance then to prevent the occurrence of such, or at all events to arrest them when they appear to threaten a lengthened continuance. Syphilis, the intimate relation of which to waxy disease of the liver has been noted, must be met by suitable treatment; and in this case, as well as in that of the other diseases already mentioned, in the course of which the hepatic derangement is apt to be developed, great care should be taken to obviate the occurrence of that cachectic condition of the system which the diseases in question are prone to engender. It is of course in the early stages of the affection that a suitable regulation of diet and the employment of tonic remedies, particularly the mineral acids and the various bitters, are most likely to prove serviceable; but even in cases which have become marked by enlargement of the liver, the use of the preparations of iodine and iron has undoubtedly proved successful in removing the symptoms of the malady. The iodide of potassium and the iodide of iron appear to have been the remedies chiefly employed and most extensively useful. Frerichs details a case in which the long-continued use of the syrup of the iodide of iron was signally efficacious. Dr. Murchison gives the preference to the tincture of iodine of the British Pharmacopœia, in doses of ten or fifteen minims diluted, three or four times daily. Many of the German physicians, and Dr. Budd in our own country, have employed with marked benefit the hydrochlorate, as well as other salts of ammonia. The writer has witnessed in several instances the remarkable subsidence of both hepatic and splenic enlargements under the use of the muriate of ammonia, in doses of from fifteen to thirty grains, freely diluted, thrice daily. In one instance, and that exhibiting the largest increase in size of the liver which he has ever seen reduced under treatment, the muriate of ammonia in scruple doses was very manifestly the means of effecting the amelioration. In this case there had been previously existing syphilis. When anæmia is notable, the use of one or other of the preparations of iron is called for. Again, vomiting and diarrhœa, which are so apt to occur in con-

holt sah ich die Kapseln der Peyer'schen und solitären Drüsen vergrössert und von weissgrauer Farbe."—Frerichs, op. cit., Zweiter Band, 179.

nection with the morbid changes in the stomach and bowels, must be met by such remedies as ice, bismuth, cerium, prussic acid, and naphtha, in the former case, and the various astringents, more particularly the sulphuric acid, and the cautious employment of opium in the latter. Diuretics and diaphoretics, rather than drastic purgatives, are to be used when the existence of dropsy adds greatly to the patient's discomfort. The moderate use of alcoholic stimulants is certainly indicated, and the diet should be as nutritious as is consistent with the enfeebled digestive powers of the patient. In the earlier stages of the disease change of air and climate have apparently been serviceable. Frerichs and Wetzlar, as well as other authorities abroad, and some at home, have recommended the baths of Aix-la-Chapelle (thermal, sulphurous, and saline), of Ems, and Weilbach; while the waters which contain the neutral salts in abundance, such as Karlsbad, Vichy, Marienbad, and Kissingen, are much less favorable from the circumstance of their being liable to produce diarrhœa. The writer has known a decidedly favorable influence to be produced by a lengthened sea-voyage, made under circumstances the most suitable as regards diet and other important particulars. And in one remarkable instance of waxy disease, involving apparently to a greater or less extent all the viscera which are liable to its occurrence, and especially characterized by urgent vomiting, the patient expressed himself as only feeling really comfortable when on the sea, remarking that there his sickness is always checked, and that even in rough weather, when most are suffering, he remains quite unaffected.

DISEASES OF THE DIGESTIVE SYSTEM.—*Continued.*

G. DISEASES OF THE PANCREAS.

By John Richard Wardell, M.D., F.R.C.P.

1. Pancreatitis.
2. Hypertrophy of Pancreas and other Changes.

General Observations.—The pancreas, like other organs, is subject to inflammation; it may be acutely, subacutely, or chronically inflamed, and such condition may be primary or consecutive. Pancreatitis is most frequently caused by the acute disease or enlargement of neighboring viscera. Adhesive inflammation agglutinates it to surrounding parts; the substance of the gland may pass into the suppurative state; or it may become indurated, softened, hypertrophied, or atrophied. Concretions may occur in the ducts, and give rise to its organic disease. Lesion may pervade the whole or only a part of its substance. It is liable to be metastatically inflamed. Its most usual morbid condition is that of scirrhus, or carcinoma, and the head of the organ is the most prone to these deposits. In carcinomatous disease of the pylorus and the right lobe of the liver it sometimes becomes in like manner affected, and passes into chronic ulceration. In its structure are found fibrous, fatty, tuberculous, steatomatous, and calcareous materials.

The diseases of the pancreas were, until comparatively recent times, little understood. Its deep and hidden situation, its proximity to other organs, and an ignorance of its real functions, were the chief reasons why its morbid phenomena were less known than the lesions of other internal parts. The two former of these hindrances to the study of its pathology can never be overcome, and must needs prevent the attainment of that more exact diagnosis which can be arrived at when reviewing the symptoms of the other viscera. The ancient fathers of physic knew absolutely nothing of its functions or affections. Hippocrates does not even mention the pancreas, and for a long series of ages it doubtless received but superficial if any attention. We must pass on to the sixteenth century before any important reference is given to this gland. It has been very aptly remarked that this disregard in the works of the ancients was amply atoned for by the consideration which was bestowed upon it by the physicians who flourished two or three centuries ago.[1] Vesalius absurdly imagined its office to be that of a cushion, to prevent the stomach, when full, from being injured against the vertebræ. Fernelius ascribed to its disorders diarrhœa, dysentery, atrophy, slow fevers, and other complaints. Schenkius believed it to be implicated in the production of a long catalogue of distempers; Riolanus conceived it to be the seat of hypochondriasis, intermittents, and many other maladies; Sylvius and his followers, amongst whom was Hofmann, connected it with the production of fevers; Highmore said it was the source of apoplexy, palsy, and hysteria; and in the works of Bartholinus, Tulpius, Hildanus, De Graaf, Blancard, Portal, Morgagni, Rahn, and other of the older authors, illustrations of pancreatic disease are often recorded. It was not, however, until Wirsung discovered its proper duct that anything reliable was known of its functions. That was the starting-point of its more accurate physiology, as well as its more correct pathology. Haller classed it with the salivary glands, and succeeding physiologists, amongst whom may be named Majendie, Gmelin, and Lassaigne, concurred in this view, nor have the more recent physiological experimenters dissented from such decision.

A right conception of its structure and office is needful in the study of its pathology. It is a conglomerate gland analogous to the salivary glands, lying trans-

[1] J. J. Bigsby, M.D., Edin. Med. and Surg. Journ, vol. xliv. p. 85. (Edin. 1835.)

versely across the abdomen, behind the stomach, its greater end or head being surrounded by the curve of the duodenum, and its lesser end extending to the spleen. It is composed of pinkish-yellow polyhedral lobules, which ultimately consist of arboriform ramifications of minute ducts. Kölliker[1] calls it a compound racemose gland, the smallest lobules of which are rounded microscopical vesicles that possess a proper membrane, and a tesselated epithelium whose cells are remarkable for fat globules, and says these vesicles are connected with small excretory ducts, the latter emptying their contents into canals of larger calibre, and the canals discharging their fluid into the duct of Wirsung, which opens into the duodenum.

According to one of the more recent analytical examinations of pure human pancreatic secretion, and which was made by Turner,[2] it is of an orange color, of marked viscid consistency, and its specific gravity 1·0105. Leuret and Lassaigne pointed out its close resemblance to the saliva, with the exception that it does not possess sulpho-cyanogen. Turner confirms this fact.

With respect to the office which this gland subserves in the economy, it was not until lately that precise conclusions were arrived at. It is true that Eberle many years ago demonstrated that its secretion had the remarkable capability of fluidifying chyme loaded with peptones, and that Pappenheim and Purkinje maintained for it the possession of a distinct digestive power on protein substances; but it remained for Claude Bernard to show one of its most characteristic properties—the change which it exerts upon oleaginous matters subjected to its influence. His investigations went to prove that the pancreatic fluid emulsifies fat, and then converts it into glycerine and fatty acid. That it also has the property of exciting the transformation of starch into dextrine and grape sugar has been long known. Frerichs avers that the emulsification of fatty food is the result of the joint action of bile and pancreatic juice. Harley thus delivers himself on this point: "There is this important difference between the action of these two secretions on fat, however, that while the bile merely emulsions and saponifies that portion of our food which enters the duodenum in the form of fatty acids, pancreatic juice, on the other hand, possesses the power not only of emulsioning and saponifying fatty acids, but also the neutral fats; indeed, its power seems chiefly to be exerted in the latter." Pancreatic juice is not the only agent which acts upon fat, the bile and intestinal secretions have a similar capability, though in much less degree, and perhaps the conversion is more complete when all these agents act conjointly. Bidder, Schmidt, Frerichs, and Turner believe it to have no influence on albumen. The most recent physiological experiments go to prove that the pancreatic fluid affects the digestion of albuminous substances, and this view is taken by Kühne,[1] Diakonow,[2] Fudakowski,[3] Schiverin,[4] and Senator.[5] The endeavor has also been made to show that saponification exerts a greater influence in the organism than assisting in the absorption of fatty matters. Radziejewski maintains that soaps can be absorbed and again converted to fat in the body.[6]

This gland may, from a variety of causes, like other glands, differ in its functions, but our means of defining such differences are extremely limited. The intimate vascular and nervous connection which subsists between it and the neighboring viscera cannot do otherwise than give rise from time to time to morbid sympathies, and thus, in no trivial manner, influence the great processes of digestion and assimilation.[7] The fluid may be generated in excess, in deficient quantity, or it may be almost or wholly wanting. From a parity of reasoning, founded on a pathological knowledge of other glandular structures, increase of vascular action, and more or less of hyperæmia, are doubtless the conditions coetaneous with and accompanying this augmented flow of the juice. There are instances of its having been given off in very large amounts, and when such is the case, if the lacteals cannot absorb the excess, it must needs then be regurgitated into the stomach, and ejected by an inverted action of the œsophagus, or pass away by the bowels. When secreted in morbid abundance, there are reasons for the supposition that it is then more irritating than normal, and if such be the case the gastric glands, as well as the intestinal surface, would be stimulated to undue action and increase of secretion. The affection known as pyrosis, or gastrorrhœa, has by some pathologists been referred not to the lining coat of the stomach alone, according to the theory once entertained, but also and mainly to the pancreas. Guersant held

[1] Manual of Human Histology. Translated by G. Busk and T. Huxley. Syd. Soc. vol. ii. p. 137.

[2] Trans. Royal Society of Edinburgh, 1860.

[1] Archiv für Path. Anat. u. Physiol. xxxix. p. 130.

[2] Hoppe Seyler's Med. Chem. Unters, Heft ii. p. 241.

[3] Centralblatt, 1867, No. 35.

[4] Dissert. Berlin, 1867.

[5] Virchow's Archiv, xliii. p. 358.

[6] Ibid., xliii. p. 268.

[7] Copland's Med. Dict., art. "Pancreas."

this view, and Copland says he maintained the doctrine prior to the first-named authority.

It is clear, from the most recent information which has been acquired relative to the pancreas, that in those instances in which a large quantity of viscid salivary-looking fluid is vomited, its production is, in part at least, referable to this gland. In some examples of chronic diarrhœa, in which a ropy tenacious secretion was voided, and which doubtless possessed many of the characteristics of saliva, this organ was regarded as the cause. Wedekind long ago believed that morbid excess of pancreatic juice gave rise to diarrhœa and dysentery. Therapeutic effects would sometimes seem to render such opinion not wholly chimerical, because we know that cholagogue purgatives are capable of producing that kind of discharge. This condition of excessive secretion may be merely functional and transient, or the result of organic lesion, and long continued. It is possible that the pancreas may be capable of taking on vicarious action, because we know the bowels are prone to do so in renal dropsy, and that this compensating tendency is one of the distinguishing qualities of secernent organs. The secretion may be diminished in quantity by the degeneration of the pancreatic substance into fat, or by its displacement by malignant deposits; also from mechanical causes, as when tumors of the stomach, liver, or other parts press upon the duct, or when it is blocked up by a calculus, or its outlet is obstructed by duodenal disease. When such is the case, the feces are apt to be rendered dry and indurated. Brunner extirpated the gland, and then observed the contents of the alimentary canal to be deprived of their ordinary moisture. The copious discharge of fatty matters from the bowels, and which will be referred to hereafter, has long been attributed to the disease or impairment of the pancreatic juice. In some cases of carcinoma of the organ, its secretion has been abolished. Bernard asserts that very slight inflammation of the viscus renders its fluid morbid and unequal to its proper influence on the chyme; it is then, he says, less viscid, coagulates by heat and acids more imperfectly, and has far less power in the emulsification of fat.

General Etiology.—With regard to the causes of the diseases of the pancreas, all that can be said must rather be of an inferential than positive character, as the etiological facts are, when attentively reviewed, but meagre and inconclusive. That its affection, by extension of morbid conditions of neighboring parts, not infrequently occurs, is beyond dispute. Claessen, however, considers this ascribed cause as overrated, and gives more importance to an inherent predisposition in the gland itself. The generality of continental writers, amongst whom may be named Hildebrand, have instanced the abuse of mercury as one of the most frequent causes of its maladies. The excessive use of tobacco has been named. The addiction to fermented and alcoholic liquors is doubtless a potent predisponent, and thus it is accounted by every authority of note. The long employment of cinchona bark has been supposed to be productive of similar results; such supposition, however, has not been founded on any reliable data. Rahn considered the predisposing cause a pituitous strumous diathesis affecting this in common with other glands. Gout and rheumatism have been blamed, and the obstruction to the menstrual discharge has also been put under the same accusation. Continued dyspepsia and chronic liver affections ought also to be enumerated. Metastasis from the salivary glands and the testicles has been adduced; and from the accounts of Portal, Mondière, and Andral there are grounds for such supposition. A few cases are on record in which the pancreas was found diseased in infants, but the statistics of Claessen show that more than 50 per cent. of the cases occur between the ages of twenty-five and sixty.

General Symptomatology.—The physical signs of diseases of this organ are obscure. Palpation affords but vague and uncertain evidence, except perhaps in those cases occurring in thin and emaciated subjects, in whom the organ is malignantly enlarged, and forms an abdominal tumor. In health the viscus can very rarely be detected. It does not move by the act of respiration. Sir William Jenner says: "The healthy pancreas can now and then be just felt in very thin persons with small lax muscles, whose lower dorsal and lumbar vertebræ are somewhat curved forward. I may have satisfied myself that I have felt it half-a-dozen times in my life. The pancreas crosses the aorta and the spine; and when perceptible to touch, it is felt on deeply depressing the abdominal walls about a hand's-breadth below the umbilicus, by then rolling the subjacent parts under the hand (the stomach and colon must both be empty)."[1] This physician also says that in such thin persons it may be taken for malignancy of the transverse arch of the colon, or for aneurism of the abdominal aorta. No symptoms are pathognomonic of pancreatic disease; an assemblage of symptoms indicates the probability

[1] Brit. Med. Journal, Jan. 16, 1869, p. 42.

of its lesion.[1] Pemberton placed more reliance upon negative than positive evidence, because he could not recognize any set of phenomena which were invariably present. Bright objected to this mode of reasoning, because he conceived it to presuppose an exactitude of knowledge, such as pertains to the other organs, which we do not possess. Siebert of Jena advocates the method of exclusion, a principle which would be erroneous if entirely relied upon; yet its partial adoption constitutes a great aid in leading to a right conclusion. The cardinal symptoms are, a dull, heavy, aching pain deep down below the centre of the epigastric region, which radiates through to the back, left shoulder, and left lumbar space, simulating the pain experienced in renal calculus, and is little increased by pressure; sickness and vomiting, sometimes thirst; constipation, which is occasionally alternated with diarrhœa; languor, emaciation, slight symptomatic fever, little acceleration of the pulse, and a clean tongue, which is not red, as in gastritis. In two cases recently recorded, one by Riboli, the other by C. Haller, and which inspection showed to have been unquestionable examples of Pancreatitis, there was scarcely any sympathetic fever.[2]

As the disease progresses, there are acid eructations, pyrosis, gastrodynia, and frequent vomiting of a clear, ropy, tenacious fluid, and the patient complains of a sensation of constriction or tension at the præcordia, sometimes of heat and gnawing in that situation, and he experiences an increase of suffering after meals, and when the decubitus is on the back. Coughing, deep inspiration, and bending the body forwards, augment the pain. Sometimes the pain resembles colic, by coming on in paroxysms, and being mitigated by the relief of flatulence. The vomited fluid bears a close resemblance to saliva, and is sometimes, as before observed, ejected in very large quantities. Frank and Trumpes state that they have known several pounds thrown off during the twenty-four hours. Abercrombie says that out of twenty-seven cases whose histories he examined, eight had frequent vomiting and thirteen had not this symptom. In thirty-nine cases selected by Claessen, thirty-five had vomiting. The bowels are confined in the majority of instances. The diarrhœa may be estimated as occurring in one-third of the patients, and the dejections are often a stringy, viscid mucus.

When the organ is acutely inflamed the secretion is doubtless suppressed, because, as Craigie observes, we know it to be the law of inflammation of glandular tissue, that its office is then suspended, and it is most likely during the declension of acute symptoms that the juice begins to be largely secreted. A secondary train of phenomena are exhibited by the progress of the malady, and these are mainly determined by the amount of tumefaction which the gland assumes, and the degree of pressure upon neighboring organs which it exerts. If it press upon the ductus communis, as it frequently does, jaundice, saffron urine, dulness of the right hypochondrium, congested or absolutely inflamed liver, accompanied by pyrexia and ascites, may result; if upon the pyloric end of the stomach, vomiting becomes urgent; and if upon the abdominal aorta, palpation discovers pulsation, and auscultation a bruit similar to that of aneurism. In about one-fourth of the cases the enlarged organ can be detected. Pressure then *does* give pain. A hard, round, deep-seated lump is felt between the scrobiculus cordis and the umbilicus. The digestion being interfered with, the assimilative functions are affected; hence anæmia, and sometimes this hydræmic state of the blood is rendered more manifest by the want of normal tonicity of the bloodvessels, by arterial throbbing in the head and neck, and a humming in the ears. The brain remains clear to the last.

One of the most remarkable circumstances connected with disease of the pancreas is the occasional *discharge of large quantities of fatty matter from the bowels.* In 1832, Dr. Bright, in an able paper read before the Medical and Chirurgical Society, brought this subject before the profession, and he thus speaks of the peculiarity in question: "The symptom to which I refer," he observes, "is a peculiar condition of the *alvine evacuation*, a portion, more or less considerable, assuming the character of an *oily* substance, resembling fat, which either passes separately from the bowels or soon divides itself from the general mass, and lies upon the surface, sometimes forming a thick crust, particularly about the edges of the vessel; if the feces are of a semi-fluid consistence, sometimes floating like globules of tallow which have been melted and become cold, and sometimes assuming the form of a thin fatty pellicle over the whole, or over the fluid parts, in which the more solid figured feces are deposited."[1] Immediately afterwards, Dr. Elliotson and Mr. Lloyd published similar cases, and the former gave a learned history of the affection, proving that this symptom had been observed by certain of the older physicians more than two centuries ago. Amongst the few instances more recently recorded may be named a

[1] Diseases of Abdominal Viscera, 3d ed. 1814, p. 64.

[2] Med.-Chir. Review, No. xlix.

[1] Med.-Chir. Trans. 1832.

very apt illustration by Mr. Clark, of Twickenham.[1]

According to the present state of our knowledge on this particular subject, it may be said that this symptom is dependent upon the absence or a vitiated condition of the pancreatic fluid and deficiency of bile; and physiological experiments and pathological observation confirm this assertion, but the ultimate mode in which the conversion is effected is not so clearly understood. It must be held in remembrance that the distinguishing attribute of the pancreatic juice is to emulsionize fatty matters, but, as I before remarked, other animal fluids possess the same property, though in far less degree. In Dr. Bright's cases two conditions were noticed —malignant disease of the pancreas and ulceration of the duodenum; and that eminent authority connected this product very intimately, if not absolutely, with scirrhus disease. Scirrhus has in repetition been associated with fatty discharge, but it is *not* essential to its formation. In Mr. Lloyd's case there was no scirrhus. In that given by Mr. Clark there was no trace of cancerous disease, and the duodenum was quite healthy, but the proper duct was plugged up with calculi, the organ entirely converted into fat, and as a consequence, none of the pancreatic fluid could be generated. As previously remarked, the intestinal secretions (especially those of the duodenum), the pancreatic fluid, and the bile are the conjoint factors which emulsionize and saponify the fatty ingesta, but the pancreatic secretion is by far the most important agent in this office, and the disease of this gland explains the voidance of fat in the dejections.

Pancreatitis.

Inflammation of the pancreas is an uncommon disease. Baillie, Meckel, and Andral do not even mention its morbid appearance, and the last-named declares that it has not been proved by necroscopy. Such assertion is, however, too absolute, as doubtless this, like other glands, does sometimes pass into the inflammatory condition. Wedekind, Daniel, and Portal speak confidently on the point; and the examples given by Lawrence, Crampton, Schmackpfeffer, Casper, Gendrin, and lately by Riboli,[2] prove Andral to have been wrong. Its functions not being so important to the economy as the functions of certain of the other viscera, the fatal termination of its inflammation must be still more rare; hence its morbid state has but in few instances been verified, and the accounts which pathologists have given of its morbid anatomy have almost entirely consisted of descriptions of the results and complications of inflammation, or of those organic or malignant changes which more insidiously supervene.

The prominent signs of acute Pancreatitis are deep-seated dull pains in the epigastrium; distension, sickness, and the vomiting of a clear or greenish viscid fluid; thirst, faintness, moist tongue, constipation, and slight pyrexia. In the few illustrations which medical literature presents, enlargement could not be detected, partly on account of the distension, and partly because enlargement belongs to the chronic, not acute condition. The characteristics revealed by autopsy have been redness, brownish redness, or whitish yellowness of color; augmented density, increased dryness and elasticity of the substance, which was in one instance dotted with bloody puncta, and uniform injection with infiltration of the interlobular cellular tissue, rendering the lobules more distinct. According to Morgagni, when the inflammation is intense and continued, the organ becomes softer and breaks more easily than in health. Gendrin saw its proper duct obliterated, and in Crampton's case the head of the gland was much tumefied. Lawrence thus describes what he observed: "The pancreas was throughout of a deep, dull red color, which contrasted very remarkably with the bloodless condition of other parts. It was firm to the feel externally, and when an incision was made into it, the divided lobules felt particularly firm and crisp." Klob is of opinion that the inflammation commences in the interlobular cellular tissue. Craigie[1] remarks that the redness and vascularity may be the effect of transudation after death; but adds, when these are accompanied by plastic effusion, pus, induration, or softening, there must have been inflammation. Rokitansky,[2] who regards this gland as being subject to the same morbid changes as those affecting the salivary glands, says, there is first tumefaction, then interstitial infiltration, and as the disease progresses a sarcomatous condensation of the cellular tissue, consequent upon plastic exudation into the areolæ; and that the congestion and reddening attack the acini, which appear to be confounded with the former, and the entire gland is enlarged and indurated. The effusion of coagulable lymph upon its surface may be productive of false membranes by which it becomes attached to one or other of the adjoining viscera, and sometimes the bands of union are dense and organized.

[1] Lancet, Aug. 1851.
[2] Med.-Chir. Rev. No. xlix.

[1] Elements of Path. Anatomy, 2d ed. p. 832.
[2] Syd. Soc. vol. ii. p. 178.

Depositions of purulent matter have been far more frequently seen than the primary conditions of inflammation, and various authors have recorded these collections, amongst whom may be named Tulpius, Bartholinus, Portal, Lieutaud, Gendrin, Percival, and Baillie. They more frequently occupy a portion than the whole of the gland. It has sometimes appeared as if the entire substance of the organ had been abolished and the capsule rendered a membranous bag filled with fluid. In other instances the pancreatic tissue has been found unchanged, its lobules being divided and floating as it were in pus. The suppurative alteration commences in the interlobular cellular tissue in small purulent deposits either in a portion or the whole of the organ, and these punctiform abscesses increase in size and number and ultimately coalesce. Rokitansky says the cellular tissue is then infiltrated with yellow pus, and the acini at a later period become fused. According to Gendrin, the glandular granules are very soft, of a reddish-gray color, rendered smaller in size, although the whole organ is enlarged. The capsule is thick and inflamed, and when the suppuration is completed the matter is mostly collected in one cavity. It is occasionally mixed with pancreatic juice, which is then a clear yellowish fluid, containing some small curds. The matter is generally inodorous and creamy, but is sometimes grayish white or of greenish hue, of faint, mawkish smell, and is in some instances extremely fetid. Portal saw two pounds of pus issue from one sac. It is always the result of inflammation. Its collection may be such as to produce injurious pressure on adjacent organs, when ulcerative absorption causes the matter to escape. Gendrin knew it emptied into the duodenum, Gautier into the stomach, and Haygarth into the intestines. It may be extravasated into the cavity of the abdomen, when death speedily ensues. The gall-ducts may be obliterated by pressure, as recorded by Percival and Haygarth, and the proper duct of the viscus may thus be destroyed.

Abscess is liable to occur in the pancreas from metastatic suppurative inflammation. It has repeatedly followed disease of the testicles. Portal cites a case in the instance of a man who had died after castration, where the spermatic cord wasted, and on autopsy a quantity of pus was found in the cord itself, and a considerable abscess in the pancreas. Antonine Petit adduces similar examples substantiating his opinion against the use of the ligature in extirpation of the testes. Tonnellie twice observed pancreatic abscess in puerperal peritonitis. Craigie has noticed it in the bodies of those who have died of ague, continued fever, and after the suppression of some habitual evacuation, as diarrhœa, hæmorrhoids, and the catamenia. There are no specific symptoms indicative of pancreatic suppuration. Rigors alternated with flushing, in conjunction with the indications enurated above, might point to such inference.

The metastatic form of inflammation may quickly pass on to *ulceration*. Again, the ulcerative process may be produced by pressure upon adjoining organs, as when the gland is enlarged in malignant disease, and thus a fistulous communication may be established.

The older authors often speak of *gangrene* of the internal organs, as if it were not an uncommon pathological appearance. Bonetus, Becourt, and Greisel give instances of what they conceived to be such condition of this viscus; and Portal very strangely asserts that gangrene of the pancreas is a frequent result! Such statements are loose and incorrect, and modern morbid anatomy proves the absurdity of the assertions which were formerly advanced. Gangrene of the pancreas is exceedingly rare. Portal says he beheld the viscus of violet-red color throughout, its substance being reduced to a pulp, and when opened a black fetid fluid escaped. Gendrin gives an example which occurred after chronic inflammation.

Storck records an instance of *hemorrhage* into the pancreas which occurred in a woman aged twenty-eight, in whom violent vomiting came on during the catamenial period, which discharge soon ceased. Dyspnœa, palpitation, faintings, and cold extremities followed. In the course of a month pulsation was felt at the epigastrium, costiveness, and want of sleep became urgent, and vomiting, diarrhœa, and wasting ushered in the fatal issue. The pancreas weighed thirteen pounds, and was found filled with coagulated blood. Another case of which I took a note in my reading, but from what author I do not remember, happened in the person of a soldier in one of the military hospitals at Cadiz during the Peninsular war. He labored under obscure abdominal disease which nothing relieved. The duodenum was found adherent to a reddish-brown tumor, which proved to be the pancreas. Not a vestige of its glandular structure remained. The capsule was a large sac the size of a child's head. It contained coagulated blood and grumous cerebral-like matter. Travers saw the gland ruptured by an accident.

Hypertrophy of Pancreas, and other Changes.

When there is *hypertrophy* of the viscus, such change has resulted from chronic

inflammation, which may have been a long-continued and an insidious disease. An albuminous lymph is deposited in the interlobular cellular tissue, which at length becomes by the absorption of the watery parts condensed and solidified, and may present the appearance of opaque septa. The acini are not much altered, and the organ is rendered larger, and harder, and drier. In some cases the hypertrophy is partial. It commonly presses upon the ductus communis, and there is jaundice;[1] Holscher knew it so compress the duodenum as to cause fatal ileus. Riolan relates that he saw it as large as the liver; Tissot beheld it three times its normal size; Rahn found it to weigh four, Westenberg six, and Storck thirteen, pounds. Portal, Bedingfield, and others relate accounts of its greatly enlarged volume.

It is sometimes *atrophied*. In cachexia, dyscrasia, and the general debility consequent upon old age, when the fatal functions are depressed as in melancholia, and in cases where there are depraved digestion and mal-assimilation, it is sometimes discovered diminished. It also undergoes this change by the pressure exerted by diseased adjacent parts, as of the stomach, liver, spleen, and right kidney, and in aneurism of the aorta. Its arteries have been found ossified, and its bulk reduced; and when the cœliac and mesenteric arteries have been of contracted calibre from osteo-steatomatous deposit, it has been preternaturally small. Its consistency in this state is by no means uniform, it having been seen soft, hard, and of coriaceous tenacity.

It is occasionally *indurated* without being associated with malignancy. The glandular lobules are then the seat of this hardness, and it may accompany hypertrophy or atrophy. It may present a cartilaginous appearance. When thus observed, its color has been reddish gray; and when cut, its substance has been drier and less vascular than normal. In simple induration the hardness pervades the entire gland, and not a part of it, as in malignant disease. A number of authors have doubtless confounded this condition with scirrhus, amongst whom may be mentioned Morgagni, Haller, Tissot, Storck, Baader, and Portal. Modern morbid anatomists define this change with far greater accuracy, yet it is incontestable that its hardened state often passes into absolute scirrhus. It is the most frequently met with in middle life and the aged. Scholler, however, once witnessed it in the infant. *Softening* has been observed in scurvy, scrofula, malignant and eruptive fevers, and in dyscrasia. Such alteration of the organ's consistency is the effect of acute or chronic inflammation. Its softening is mostly associated with increase of size, it is readily lacerable, and is of gray or yellowish-green color.

Fatty degeneration of the pancreas is sometimes met with in accompaniment with fatty decay of the heart, liver, and kidneys, and, according to Rokitansky, this appearance has mostly been found in confirmed drunkards. Fearnside records an instance in which the whole gland was in a great measure converted into fat, and he points out how it differed from mere deposition in the interlobular cellular tissue. Cruveilhier remarks upon the difference between transformation of the glandular substance and fat interposed in the laminous texture. The microscope exhibits the partial conversion of the lobules into and their utter displacement by fat. The entire organ may be transmuted into one fatty mass.

I believe *Scirrhus* to be the most common malady affecting the pancreas. It may be located in one part or pervade it entirely. In the majority of examples it is the duodenal end which is diseased, and the gland generally becomes enlarged, but in exceptional cases there is diminution of bulk. I also believe this to be very rarely a primary formation, for other organs nearly always, when carefully examined, exhibit the same heterologous product. When the affection has for some time existed, adhesion to adjacent structures ensues, and there may be open ulceration. By pressure of the tumor ulcerative absorption takes place, and thus may eventuate perforation of the diaphragm, erosion of the vertebræ, and rupture of the vena cava. This kind of enlargement has been known to constrict the abdominal aorta and stimulate aneurism. The duodenum by its proximity is more frequently implicated than any other part; its mucous membrane becomes ulcerated, and there is adhesive inflammation. The hepatic and common ducts become contracted, sometimes they are blocked up and absolutely disorganized, and thus the functions of the liver are interfered with, and icterus comes on. The natural secretion of the gland is diminished in quantity, or so changed in quality as to irritate the lining membrane of the upper part of the alimentary canal; again, the cancerous deposit sometimes fills up or destroys the duct, when no pancreatic juice can pass into the bowel, the characteristics of the chyle become changed, and the feces are rendered dry. Dr. Owen Roberts, of St. Asaph, has kindly given me the particulars of two cases in which the organ was thus affected, and which recently came under his notice. One was in a woman of sixty-five, who for long had pain in the back, and who died consider-

[1] Bedingfield, Todd, Percival, Crampton, and others give such illustrations.

ably emaciated. The pancreas was found large and hard at the duodenal end, and the common bile duct was obstructed, which accounted for the jaundice and absence of bile in the stools. The other case was in that of a medical man, whose pancreas was thus diseased, but in him there had not been pain in the back nor any jaundice.

The *encephaloid* form of cancer is far less frequently found than the kind above described, and when it has been noticed there has generally been also medullary sarcoma in some other organ. It is observed as soft, curdy, or cerebral-like matter. In two cases given by Abercrombie, the encephaloid deposition was arranged in yellow and white layers. The consequent open ulceration may give rise to fatal hemorrhage, as related by Videl.

Da Costa has professed to diagnose cancer of the pancreas from its other maladies, but the truth is we have no just rules of observance to point out any real distinctions. Pain at the epigastrium, sickness, vomiting, and constipation have been instanced as cardinal symptoms by Claessen and others, but they have also been given as the symptoms of simple inflammation of the gland, therefore they cannot be regarded as pathognomonic of carcinoma.

Bright once saw *Fungus Hæmatodes* of the pancreas, and the same statement has been made by other authors, but it is extremely rare. There are specimens of *Melanosis* of the organ in the museums of the Royal College of Surgeons and St. Bartholomew's Hospital. *Tubercle* has been noticed by a few pathologists, but only in phthisical and strumous subjects, and as the accompaniment of the same condition in other organs. *Steatoma* is another product which some writers have mentioned, but I believe it to have been but another name for tubercle. As in the salivary glands, *calculous concretions* are formed in the pancreas. They are mostly discovered in the main duct, but they have been also observed in its minute ramifications, presenting the appearance of small particles of white earthy matter. They are of irregular surface, and vary greatly in size and number. They may not be larger than a millet-seed or equal to a hazel-nut, and nearly one hundred have been counted. Schupmann[1] found one measuring one inch and six lines in length, and which weighed more than three drachms. Wollaston and Fourcroy proved them to consist of phosphate of lime in combination with some animal matter. *Cysts* have been spoken of, but dilatations of the ducts have been mistaken for such growths. Cysts in this organ may have their origin in areolar expansion or from distension of the duct; the same occurs in ranula with obstructed submaxillary duct, and a like cystiform dilatation is sometimes seen in the Fallopian tube. Professor Turner, of Edinburgh, saw an excellent illustration of cystiform dilatation of the pancreas from obstruction of the duct, in the body of a man who died with cancer of the head of the viscus. The pancreas at first sight looked like a multilocular cyst; but examination showed the cyst-like dilatations to be expanded acini filled with the thickened secretion of the gland.[1]

[1] Hufeland's Journal, April, 1841.

Diagnosis of Diseases of Pancreas generally.—It is only approximately that the diagnosis can be accomplished. The functional affections of the pancreas cannot be recognized, and it is only when its maladies have made progress, and the other viscera have become implicated, that they can with anything like certainty be inferred. The low degree of sensibility with which the organ itself is endowed, and the great sensibility of organs with which it lies in juxtaposition, its depth in the abdomen, the inconsiderable effect which its lesion exerts on the circulatory, nervous, and secretional systems, and the resemblances which the diseases of the liver, stomach, and duodenum bear to those of this gland, are some of the many causes constituting this difficulty. Strict regard should be paid to the symptoms before enumerated, and the complaints incident to the stomach, liver, spleen, and duodenum should as far as possible be excluded. Kreysig and Hohnbaum place most confidence in the sickness and the slimy fluid which is vomited. Wasting, and the discovery of particles of fat in the feces, are by Lussanna considered the most reliable signs. But we now know that fat may be passed in the alvine evacuations when the duodenum and not the pancreas is diseased: hence this symptom is not pathognomonic. Again, with regard to the pain: Abercrombie says there may be great disease with little or no pain. Swelling of the parotid glands has been noticed as a vicarious affection. Cancer of the pylorus, enlargement of the liver, spleen, mesenteric and mesocolic glands, encephaloid tumors, impaction of feces in the transverse colon, should, if possible, be excluded. Da Costa commends the exclusive method, and doubtless the attempt to diagnosticate will be facilitated by the observance of such means in addition to a due regard to those conditions which are looked upon as the more positive indications.

[1] Paget's Lectures on Surgical Pathology. Edited by Turner. London, 1863, p. 393.

TREATMENT. — From what has now been said relative to the difficulty which there is in diagnosticating disease of the pancreas, the treatment must needs be more doubtful and less satisfactory than the treatment addressed to organs whose morbid conditions can with greater certainty be interpreted. There are no medicines which have a special power in counteracting its maladies. The treatment must be conducted on those general and acknowledged principles which would be equally applicable to other internal parts. If we believe acute inflammation to be present, the ordinary antiphlogistic measures should be adopted. Cupping or leeches may be used; and if there be hot skin, quick pulse, and great pain, and the patient is robust and strong, moderate general blood-letting may be employed. Emollient cataplasms, hot and repeated fomentations, terebinthinate and opiate epithems often give relief. When the more acute symptoms have declined, blistering tartar-emetic ointment, croton-oil liniment, belladonna and opiate plasters, or the linimentum hydrargyri, or the emplastrum hydrargyri, can be tried. If the pancreatic affection be considered metastatic of parotitis, a blister should be applied to the parotid gland. The bowels should be kept open by laxatives, such as castor-oil, the confection of senna, or the compound rhubarb pill, with a little of the extract of henbane. The empirical plan of some of the older physicians, of giving an opiate at bedtime and a gentle aperient in the morning, may be followed. If sickness and vomiting be urgent, hydrocyanic acid, and small doses of morphia in a mixture of mucilage or almond emulsion, are likely to be serviceable; effervescing draughts and creasote in pills, and small quantities of brandy in iced water, may be given. If there should be much pain, opiates in some form must be had recourse to; and if the irritability of the stomach be such as to reject them, they should be administered hypodermically or by enemata. If we are impressed with the conviction that the affection is carcinomatous, palliatives can alone be used with advantage, and the surest of these is opium. Mondière, in such cases, gives importance to revulsives, and praises the use of the moxa. The diet should be bland and nutritious, such as nourishing soups, jellies, milk, and farinaceous food. If there be acidity in the stomach, milk and lime-water should be given. Rest in the horizontal posture should always be insisted upon.

DISEASES OF THE BLOOD-GLANDULAR SYSTEM.

A. The Spleen.
   - Inflammation.
   - Hypertrophy.
   - Neuralgia.
   - Tumor.
   - Softening.
   - Induration.
   - Atrophy.
   - Hemorrhage and Rupture.
   - Gangrene.

B. Leucocythæmia.

C. The Lymphatic Glands.—Hodgkin's Disease.

D. The Supra-renal Capsules.—Addison's Disease.

E. The Thyroid Body.—Exophthalmic Goitre.

[F. Bronchocele.]

DISEASES OF THE SPLEEN.

By John Richard Wardell, M.D., F.R.C.P.

Diseases of the Spleen most frequently prevail in marshy districts and tropical countries, and as the complication of intermittent and remittent fever. Acute Splenitis implies inflammation of the serous investment, which sometimes extends from the parenchyma, but which, in the majority of instances, occurs by continuity, when other internal parts are inflamed. Inflammation of the Spleen, when not referable to wounds or external violence, is never a primary but always a secondary complaint. The most common affection of this organ is that of subacute or congestive splenitis. The viscus may be very large and turgid without being inflamed, and such state sometimes comes on with much suddenness. The parenchyma is far less prone to acute inflammation than the envelopes. The organ may be the seat of great pain, constituting splenalgia, or dolor lateris, when quite uninflamed. It passes into suppuration, and abscesses of various sizes are formed in its structure. It is often greatly enlarged in European children who are resident in the tropics. In leucocythæmia the organ attains very great magnitude. In dyscrasia, and especially in that degradation of the circulatory fluids which obtains in periodic, continued, malignant, and exanthematous fevers, the Spleen undergoes marked appearances of organic change. Morbid anatomy discovers, as in the other viscera, the ordinary inflammatory products, hypertrophy, atrophy, induration, softening, and gangrene. On its tunics are sometimes witnessed fibrinous, cartilaginous, and ossific conversions. In its substance are occasionally seen fatty degeneration, amyloid deposition, hydatids, cysts, and the tuberculous, cancerous, osseous, and calcareous changes.

General Terminology.—Σπλήν (Gr.); Splen (Lat.); Rate (Fr.); Milz (Ger.); Splenitis (various authors); Lienis inflammatio (Boerhaave and Van Swieten); Splenitis phlegmonodea (Sauvages and De Haen); Splenalgia suppuratoria (Sauvages); Empresma splenitis (Good); Splenitis peritonealis acuta (Craigie); Splenite (Fr.); Entzündung der Milz (Ger.). The non-inflammatory affections have been variously named Congestion, Turgescence, and Hyperæmia of the Spleen. And when pain has been the chief characteristic, Splenalgia, Dolor lateris, Splenis Dolor, and Splenic Pain, are terms which have been commonly employed. In certain districts it is usual to speak of its chronic enlargement in the vernacular, as Disease of the Milt, or the Ague Cake.

There is scarcely any part of the human body of which more has been written and respecting which more theories have been propounded than the Spleen. Its doubtful purpose in the economy has evidently constituted the main cause of the great consideration which has been bestowed upon it, and of the numerous and varied hypotheses which from distant ages have been enunciated. The most ancient ac-

count which we have of this viscus and the disease to which it is liable is to be found in those writings which are attributed to Hippocrates, and where the organ is so prominently mentioned in relation to the well-known doctrine of the four humors. When Haller began to write on this subject, he premised his observations by saying that he was plunging into the region of mere conjecture, darker than in the case of any other viscus. Though much respecting its use has in recent times been made out, still there remains, as relates more especially to its functions, a good deal that is speculative and not fully accepted, and in the commencement of this article the writer cannot feel unimpressed with the figurative but emphatic declaration of Haller. The knowledge which we have of its office, and the pathological changes to which it is subject, is by no means so clear and absolute as our knowledge of most of the other internal parts. It would be out of place here to give in any lengthened detail the doctrines which have from time to time been put forth and successively fallen into oblivion, but to some of these a passing reference may be made. In remote ages it was remarked that an enlargement of the Spleen was generally accompanied by an emaciated condition of the body. In the Hippocratic collection, it says "those persons whose Spleen is large have their body meagre." The same idea is to be found in the *Timæus* of Plato, and which, it is related, gave rise to the well-known comparison of Trajan, who said that the Imperial treasury was like the Spleen, because when that was rich the people were impoverished. Aristotle believed the Spleen to assist the liver in digestion, that it attracts from the stomach superfluous and excrementitious humors (*ἰχμάδας τὰς περισσάς*), and corrects them. Plato supposed that its office is to relieve the liver when distended. Galen, whose opinions were evidently more widely accepted, and longer assented to than any of the opinions which before his time had been advanced, imagined that the humor called black-bile (*χολὴ μέλαινα*) is secreted by the Spleen, in the same way as the yellow bile (*χολὴ ξανθή*) is secreted by the liver. The Arabian physicians and the few philosophers, who, in the sparsely scattered seats of learning, lived in the dark ages, were evidently contented with the Galenic theory. Aretæus had arrived at the idea that the Spleen is nourished by black-blood (*μέλαινα χολή*), and hence the terms *melancholy* and *splenetic*. Orbasius, Trallanus, Paulus Ægineta, Actuarius, Haly Abbas, Protospatharius, and Meletius held to the views of Galen. Erasistratus deemed it as being of no real use in the body. Avicenna conceived that, being an organ so surcharged with blood, warmth is imparted to the stomach, and thus the process of digestion becomes aided; and certain of the Arabic writers entertained the chimerical notion that its office is to cool and refresh the heart. Such were the crude conjectures and vaguely defined doctrines which have been transmitted from ancient times. They were the mere expressions of speculation and the flights of fancy, without being based upon inductive reasoning, and having little or no foundation in experiment. With certain modifications they were held until the beginning of the sixteenth century, that epoch which is regarded as the period of the revival of letters and philosophy, when the works of the ancients became more carefully and more generally studied, and their opinions were subjected to closer examination and nicer criticism. Some of the anatomists who then flourished looked upon the vasa brevia as ducts passing from the stomach. Franciscus Ulmus imagined the Spleen to be possessed of certain properties necessary for the preparation of the blood for the heart and arteries, and Tel Plater also was of opinion that it had the function of elaborating the blood, rather than the function of attracting the melancholic humor (Gray). Other of those remote writers, as St. Ambrose, modified the Galenic notions and contended that the Spleen draws away the useless part of the aliment, and after its retention for a time transfers the purified and subtle remainder through the liver to the blood. Less antiquated hypotheses than those of the Grecian and Roman philosophers are to be found in the works of the Schoolmen who flourished in mediæval times; but they likewise lay claim to no serious regard, as their theories, like the theories of those who had long preceded them, were but the chimeras of caprice and delusive imaginings, devoid of proof, and readily to be contradicted by experiment. Some thought the organ secreted a fluid which passed into the stomach; some, that it elaborated a product necessary to the nervous system, and others that it produced a sort of chyle.

Coming down to more modern times, and even to recent periods when physiological problems have been cautiously tried by, and only found an accepted solution in accurate and repeated experiments, still the entire uses of the Spleen have not been finally determined, and many distinguished names have been the adherents of opposing views. Müller thought its importance in the economy less than many other authors supposed, and averred it fallacious to maintain that it is essentially connected with the function of the liver. Mead and Meyer deemed it necessary to digestion, Tiedemann and Gmelin were convinced that it gen-

erates a certain kind of lymph which serves to form the blood-globules, and Kölliker, Funke, and Billroth incline to the last-named supposition; Dollinger regarded it as a sort of symmetrical appendage to the liver; Lieutaud and Moreschi looked upon it as a reservoir to accommodate the blood of the stomach when that organ becomes distended with food, and when more blood is sent to it during the process of digestion; Sir Everard Home revived the Hippocratic theory of the Spleen receiving fluid from the cardiac end of the stomach to be thence carried into the circulation; and Ecker and Beclard say that one of its chief uses is for the solution and destruction of the blood-globules. Microscopical anatomists, and especially those of Germany, first paved the way to more precise and definite conclusions relative to this organ, and of late years pathologists have been induced to study its varied diseases with more interest than was formerly the case. If reference be made to systematic writers on this subject, it will be seen that there is not that satisfaction, not that conviction, expressed which is to be observed in the articles treating on the ailments incident to the other viscera. The difficulties which have beset authors in their descriptions of the Spleen and its maladies have arisen from a variety of causes, and not only from a want of knowledge of its functions, and amongst the chief of which causes may be instanced its peculiar situation in the abdomen, being deep in the left hypochondrium and surrounded by organs which are regarded as more prone to disease, and with whose symptomatology physicians have been long more familiar; by its being hidden as it were by the thoracic wall; by its capability of sudden and even great distension without giving rise to any serious inconvenience in the system; by its comparatively simple action; by its low degree of sensibility; by its diseases not being endemic in this as they are in malarious countries; and by there being an erroneous impression that splenic complaints are by no means common. From what, therefore, has now been said there are difficulties in the diagnosis of its lesions which do not obtain with many other organs. Being a ductless gland, and not influencing any secretion or excretion, nor giving off any secreted product that can be submitted to examination and experiment, its morbid phenomena cannot be studied and comprehended with the same certitude and exactness with which we can investigate the diseases of the liver and the kidneys. The vascular glands, of which the spleen may be regarded as the prototype, though they differ from the secernent glands, are importantly connected with the process of sanguification. By some modified mode of secretion they abstract certain materials from the blood, act upon such materials, and then restore them to the circulation without being eliminated by any duct or outlet from the organ. There is then great analogy in function between the blood or ductless glands and the secreting glands. Between nutrition and secretion there is great analogy, and the processes proper to vascular glands are partly nutritive and partly secretive. That other organs can vicariously assume its office in the economy, and that it is not absolutely essential to health or even to life, is evident, because it has been extirpated in the human subject and the patient has lived thirteen and a half years and enjoyed health. It has been found so exceedingly small as to be quite in a rudimentary state, and it has been said to be altogether wanting. Even in health, as Bright observes, its volume, consistence, and position may vary from so many causes that it is not subject to the same rules and precision in the investigation of its maladies as can be brought to bear upon other viscera. The advances which microscopical anatomy, experimental physiology, and animal chemistry have latterly made, and are still making, promise much in clearing up certain mysteries which yet remain, as I have already remarked, with regard to the Spleen. It is becoming more admitted, and it is certainly incontestable, that even in the British Isles, where the endemic element in the causation of its morbid affections obtains to an infinitely less extent than in former times, it is more frequently the seat of diseased action than the older authors were led to suppose. The increased attention which clinical teachers have recently given to physical diagnosis in all forms of abdominal complaints has contributed more and will contribute still more to the comparative accuracy with which we can judge of its lesions.

It may here be remarked to the reader that a knowledge of its position in the abdomen, of its anatomical and microscopic structure, and, so far as we can speak, of its functions, is essential to a right comprehension of its ailments. Hence, in attempting to treat of this subject in any systematic work on medicine, such must needs be done in a somewhat exceptional manner. It must be remembered that in health the Spleen cannot be felt. If it can be felt and is not really diseased, it is then displaced. Lying obliquely in the left hypochondrium and in intimate relation with the diaphragm, by which it is separated from the ninth, tenth, and eleventh ribs, its situation necessarily varies with the act of respiration—a fact never to be forgotten in

diagnosis. In the deepest expiration its upper end will ascend to the lower edge of the eighth rib; and in the deepest inspiration, when the organ is normal in volume, it never descends below the cartilaginous margin of the chest. It is attached to the stomach and the pancreas, and at its lower angle it touches the left kidney. Its size varies more than that of any other organ in the body, except the uterus and the ovaries. The greatest weight of anatomical evidence goes to prove that this viscus is a single organ in the body. In its earliest development it appears in the median line. Dr. Embleton thus expresses himself on this point: "The Spleen originates in the median line of the body, is gradually carried thence to the left hypochondrium, and it ought to be regarded as originally median and not belonging to the left side more than the right." This writer then cites a number of ancient and modern authorities who look upon it as a single organ.

The *peculiar structure* of the Spleen is not only a circumstance carrying with it much physiological interest, but it has a direct and an important pathological significance. Its distensile qualities intimately concern its lesions; indeed, this property constitutes one of the main causes of its most frequent morbid changes. Its capsule is of fibrous structure and invested by the peritoneum, and this tunica propria, being of elastic tissue, enables it to yield to the greater or less distensions of its vessels. It everywhere incloses the parenchyma. From the inner surface of the elastic tunic sheaths are formed for the vessels and their ramifications, and from these sheaths fibrous septa and bands (trabeculæ) are given off innumerably, and these form cells (loculi) into which the blood is effused. This fibrous coat is composed of white and yellow fibres, the first-named consisting of parallel bands, and the last mentioned being united in a densely reticulated arrangement. According to Kölliker, the trabecular tissue, in its elementary essentials, closely corresponds with the fibrous capsule, since it exhibits both white and yellow fibres; and he considers them as being muscular, thus on this point agreeing with Malpighi and others who had persistently regarded the partitions of the Spleen as being muscular. One of the most recent writers (Marshall) on this particular question, entertaining the same opinion, says: "The proper coat, the sheaths of the vessels, and the trabeculæ consist of white fibrous and areolar tissues, mixed with elastic fibres, and contain, especially in animals, pale fusiform, unstriped muscular fibre-cells." The splenic capsule is very yielding, and the walls of its vessels are unusually thin. This slight elasticity accounts for the slow disappearance of the organ's distension when from any cause it has become surcharged with blood. The mode in which infected blood still further diminishes its distensile properties is mainly, as it would seem from the experiments of Jaschkowitz, by a greater or less degree of paralysis induced in the branches of the sympathetic which go to this viscus. There is no doubt, however, that mere and continued mechanical pressure exerts its effects upon these nerves.

There is no organ which receives a greater number of bloodvessels in proportion to its size than the Spleen, and its extreme vascularity has always been dwelt upon by anatomists as one of its distinguishing features: and this fact, as Bichat remarks, becomes more worthy of notice because it secretes no fluid. The splenic artery, which is the largest branch of the cœliac axis, and which near the organ breaks up dichotomously into five or six branches named the *rami splenici*, is a very large bloodvessel in proportion to the organ it supplies. When these rami enter at the hilus, they divide into innumerable subdivisions, nor do they anastomose, and they soon divide into a coarse capillary network, and this retiform structure quickly ends in minute veins. The splenic vein is of very considerable calibre as compared with the artery and the volume of the viscus. According to Home, Piesker, and others, it is five or six times larger than the artery, and its coats are very thick and it has no valves. It constitutes the way of return, by many tributaries, for a large volume of blood, as it takes the venous blood from the pancreas, duodenum, the greater part of the stomach, and sometimes the left colon and part of the rectum.

The red splenic pulp or parenchyma occupies the spaces between the trabeculæ and the exterior of the vessels. It is a soft, bluish-brownish mass, which becomes redder when exposed to the atmospheric air. It consists of a colorless, granular parenchyma, mixed with colored cells and red blood-corpuscles, the colorless portions being composed of variously shaped nucleated cells and a finely granular plasma, and which, it has been said, resembles the ultimate materials entering into the formation of the solitary and agminated glands of the intestines. Physiologists regard the colored cells as altered red blood-corpuscles and as being peculiar to the Spleen. Some are smaller than the ordinary blood-globules, others are yellow, brown, or black, and their pigments may be seen in depositions which are crystalline or granular. In the spleen-pulp are the Malpighian corpuscles, which are small white, soft bodies, measuring from the sixth to the third of a

line in diameter; they are attached to the small arteries and trabeculæ, and arranged in sessile manner like buds on a twig, but they have no communication with the arteries, and their contents are granular and nucleated cell elements. They are so numerous that they are said to form one-fifth or one-sixth of the splenic pulp. It has been noticed that they are absent in the human Spleen after protracted disease and in starved animals, but very observable in health and when the body had been highly nourished.

The nerves of the Spleen are derived from the solar plexus, and they form an interlacement called the splenic plexus. The nerves are relatively small as the vessels are relatively large, a fact acknowledged from the time of Aretæus, and hence the little sensibility with which this internal part is endowed. The nervous filaments follow the course of, and may be traced in, the minute arterial branches which go to the Malpighian corpuscles, and pass into the pulp. Embleton believes the gland may receive nerve-twigs from each pneumogastric and the sympathetic ganglia on each side; such anatomical arrangement has not yet, however, been fully determined.

During the process of digestion the Spleen is temporarily enlarged, which can be understood when it is considered that the vasa brevia are branches of the splenic artery which inosculate with the gastric artery and the gastro-epiploica sinistra. When the stomach is distended with food, more blood is sent to those vascular connections, and the Spleen, by its accommodating structure, receives any undue supply of blood which, during the activity of the digestive functions, is determined to these parts. When there is loss in the force of cardiac action, its congestion is a consequence; and when the volume of the circulation is diminished by hemorrhage, or when irritation in the gastro-intestinal membrane is followed by serious diarrhœa, it can at once be comprehended how this viscus will be reduced in size. Physiological experiments have gone to confirm the opinion long ago advanced by Hewson that this gland is engaged in the formation of the germs of the blood-corpuscles. It is probable, though not absolutely certain, that it is also engaged in their disintegration. M. Picard has recently demonstrated that the organ contains a proportion of iron four times greater than that of the blood itself. It is by some confidently stated that in diseases of this organ, pigment masses, the débris of broken-up blood-cells, have been discovered. The blood-cells of this organ are of varied color, and it is probable they are not only there disintegrated, but it has been conjectured that materials from the red corpuscles, such as the pigments, may be again used in the germs which go to constitute the new corpuscles. Kölliker not only regards its functions as concerned in the renewal of the blood, but he believes, with the ancients, in the secretion of bile also. This doctrine is, however, a mere hypothesis. That the Spleen acts as a diverticulum to the visceral circulation is much more certain than anything we know of its other uses, and that it is destined to a more exalted office than that of being a sort of mechanical contrivance, or vascular reservoir, is now sufficiently conclusive, for had such been its mere purpose, there would then, as it has been remarked, have been no need for its peculiar parenchyma, and a simple plexus of bloodvessels would have subserved such end. Towards the termination of the digestive act, not only is its entire volume increased but there is also an absolute augmentation of the spleen pulp, and also of the Malpighian bodies. It attains its largest dimensions at the termination of chymification, and if no food for some time be taken, it then becomes gradually reduced in volume. The resilience of its elastic tissues renders it particularly adapted for taking in a surcharge of fluid during the torpor of the vascular system which results from digestion. In disease its peculiar capabilities are made subservient to the altered requirements of the circulation. In hepatic affections, more particularly in cirrhosis, it can be comprehended, from the foregoing physiological facts, how frequently the Spleen is involved. The blood of the splenic veins must pass through the liver, and if there be obstruction in the last-named organ, a backward retardation in the circulation of the Spleen must necessarily be produced. In chronic cardiac disease, and especially when the right side of the heart is enlarged, this organ from venous obstruction becomes tumid. In children it should be borne in mind that the Spleen, like the liver, is relatively large. Gray considers its office is to balance the quantity as well as the quality of the blood, which it is able to do by its connection with that part of the vascular system which is concerned in introducing new materials into the circulation. Its contraction and relaxation, it is possible, may be influenced by the sympathetic system, because electrical currents, as it has been shown by experiment, cause the organ to contract. The views of Carpenter relative to the use of the Spleen seem so apt that they may here not inappropriately be quoted. "We are inclined to believe," says this eminent authority in a review, "that the office of the *colorless* parenchyma of the Spleen is not only to serve as a storehouse for the surplus albumen that finds its way into the circulation on the completion of the

digestive process, but also to excite an *assimilating* action upon it, whereby it is rendered more fit for the nutrition of the tissues, and of this assimilating action we deem the generation of fibrin to be one of the results. And if it be true, as we have elsewhere suggested, that one special function of the red corpuscles is to assimilate or prepare that peculiar combination of materials which is required for the nutrition of the nervo-muscular apparatus, the disintegration of these corpuscles in the splenic parenchyma may answer the twofold purpose of regulating their total proportion in the mass of the blood, and of diffusing, through the liquor sanguinis, the materials which the nerves and muscular tissues are to draw from it for their own development."[1] Maggiorani, from experiments on the lower animals, concluded that the Spleen has the double function of presiding over a metamorphosis of organic elements and of accumulating iron for hæmatin. And Jaschkowitz found that section of its nerves caused to it increased flow of blood and increase of hæmatin-pigment. If we acknowledge such as being certain of the functions of the Spleen, much light is necessarily thrown upon those affections with which its more manifest diseases are associated.

The relation which subsists between the Spleen and the lymphatic glands, which was first pointed out by Hodgkin, and the discovery of an excess of white corpuscles in the blood in the form of its chronic disease, are facts which have added very much to our knowledge of its functions, and will doubtless be followed by still more precise information. It has also been stated that there is some relation between the Spleen and Peyer's patches, and it is a point of considerable interest, as Sir William Jenner observes, that the Spleen, the lymphatic glands, and Peyer's patches all suffer involution at the same period of life—about fifty. This writer also remarks that at that time the Spleen becomes less, the lymphatic glands waste, and Peyer's patches smooth down; and that it is at this period of life that the diseases, and especially enteric fever, in which these parts are involved, cease to be common.

General Etiology.—Diseases of the Spleen are limited to no particular period of life; we see them in infancy, in middle age, and in advanced years; and males, from their more frequent out-of-door occupations and consequently greater exposure to external influences and their less temperate habits, are more liable to them than females. With respect to the causes, none is more prolific than that which is endemic; and to malarial agency, splenic lesion, and those affections with which it is so commonly allied, have, from the remote times of Hippocrates, Livy, Tacitus, and Plutarch, down to our own, very consentaneously been attributed. In such of those writings of the ancients which have descended to us, and in which are discovered descriptions of splenic complaints, the causation now instanced, is prominently mentioned. During many subsequent centuries, when learning and philosophy were confined to the few, and when popular opinion was tinctured by and received its bias from the schoolmen, the same doctrine, with other and far less correct notions, was maintained. The physicians in mediæval times concurred in these views. Modern authorities, more especially those who have written on the diseases of tropical countries, and such as are met with in the vast range of our colonial dependencies, have abundantly pointed out the malarial origin of the majority of the ailments incidental to this viscus. In the fenny counties of England, more especially those of Cambridge, Lincoln, and Essex, from time immemorial to that in which we live, splenic complaints have prevailed. In the East and West Indies; in the Southern States of America, and particularly in the extensive river plains of that continent; in China, Canada, and in Australia; in Hungary, in Holland, in Italy, and in those countries bordering on the shores of the Mediterranean, this etiological influence is so well known as to need not more than a passing reference. In tropical countries, where great heat and moisture prevail, or those parts formed by the deltas of great rivers where the soil is composed of alluvial and vegetable remains, and where paludal exhalations are given off, the causation is rife. Inundations from the sea, and great inland floods, or where sea and fresh-water for a time stagnate and then disappear, render low grounds extremely insalubrious, and there the affections considered are in great degree produced. In Holland, where these inundations have so often occurred, the effects described have as the rule always followed. In that country, after the partial inundations by the sea in some places in the winter of 1825 and 1826, during the following summer, when the sun's rays dried up the earth which had been so long saturated, the decomposition of organic matters ensued, and the concentrated effluvia were succeeded by fevers of a remittent type with splenic complications. From the accounts which have been given of the endemic diseases in Hungary, in the summer and autumn, when the hot weather has promoted the decomposition of organic materials, fevers of an adynamic type with Spleen affection very commonly prevail. In former times, when in our own country vast tracts of forest and marsh

[1] Brit. and For. Med.-Chir. Review, Jan. 1855.

land lay in a state of nature, when the kingdom was thinly populated, and before reclamation and drainage became so general, the maladies incident to this organ were often observed. Again, paradoxical as it may appear, cultivation and drainage may have a deleterious effect. It has been repeatedly affirmed that in the tropics and in our colonies, where the ground was thick with trees and overgrown with rank vegetation, that such places were more healthy than immediately subsequent to the efforts of the cultivator. The trees and undergrowth keep off the sun's rays, but when they are removed, and the soil first becomes subjected to heat, miasms are then far more abundantly exhaled, and it requires a succession of seasons—sometimes many years—before the new ground has fully given off the poisonous gases which under such circumstances had been generated. Dr. Rush has recorded the kind of effects now spoken of which took place after the clearings in the primæval forests of Pennsylvania, and in the works of Montfalcon and Bailly similar testimony is given. Sometimes higher situations are more dangerous to live in than the situations beneath them, because the miasms may be wafted away by prevalent winds, and the emanations may be concentrated in the vapors which rise from the valleys, and carried upwards to be intercepted by acclivities and neighboring eminences. This fact has been long observed, and the explanation now advanced has been generally acknowledged. The various records of our military expeditions, and the statements made by medical men who have resided in our colonies, abundantly attest the correctness of these remarks. These authorities also have told us that the new residents in such places are far more prone to malarious attacks than those who have in some measure become acclimatized. Great and prolonged muscular exertions, which not only determine the blood to the internal organs, but absolutely produce changes in the constitution of the fluid, such as protracted and fatiguing marches and the laborious operations of active service, together with great privations, bad food, the use of stagnant water and water which has run through marshy districts, sleeping in damp situations or in the open air without sufficient covering, and mental depression produce splenic complaints. Blane and Dawson, in their respective accounts of the Walcheren diseases, give prominence to such causes. Sudden transitions of temperature which occur in those climates where hot days are succeeded by cold nights, and where periodic rains produce a rapid fall in the thermometer, have been mentioned by various writers. The blood is then quickly determined from the surface to the visceral organs, and from what has already been said of the accommodative and distensile qualities of the Spleen, it can be comprehended how such abrupt repletion of its vessels must, if such surcharges were continuously repeated, tend to the permanent enlargement and structural alteration of the viscus. Periodic fevers thus produce its hypertrophy. Sir J. Ranald Martin thus expresses himself on the point now considered: "The most ordinary cause of splenic congestion," says this writer, "whether active or passive, will always be found in the malarious fevers of the East—remittent and intermittent—which, for longer or shorter periods, and by the recurrence of their cold or congestive stages for months or years together, disturb or eventually destroy the balance of the abdominal circulation, and with it the integrity of the abdominal functions. When to these morbid conditions we add destitution, the absence of comfort in food and clothing, the residence in low, cold, and damp localities, mental depression, those causes, in short, which contaminate the blood, and determine its flow into the abdominal organs: all these causes will powerfully tend to the production of splenic disease."[1]

Morbid changes in the blood itself, effected in a more direct and in an immediate manner, are to be noticed; as the absorption of noxious effluvia, which at once operate upon the circulatory functions and are followed by visceral turgescence; the specific poisons of the various forms of fever, and the retention of effete matters from the imperfect action of the depurating organs and especially of the kidneys. In those contaminations of the blood associated with pyæmia, septicæmia, or icorrhæmia, the Spleen not infrequently assumes the purulent condition. There is no doubt that as the common event this gland becomes tumid where there is metastatic infarction and when infectious thrombi circulate in the blood. The loss of nervous power consequent upon some depressive agency affecting the great nervous centres which diminish vital cohesion, and those cachexial changes which proclaim debility, are also to be enumerated.

Twining speaks of an assemblage of symptoms, all caused by debilitating influences and tending to asthenia, which obtain notably in Bengal, affecting not only the European residents but also the native population, and which he calls the endemic cachexia of the tropics, as being a condition markedly associated with splenic complaints. In the complications and sequelæ of intermittent fever, this organ is very commonly attacked. Pem-

[1] "Tropical Climates," second edition, p. 501–2.

berton says it is most frequently affected by quartans. In the continued fevers, more especially in those instances in which there are hepatic symptoms and where the adynamic type is assumed, its disease is very commonly noticed. Tweedie speaks of often having found it soft and enlarged. Barrulian in 1202 cases of typhus discerned the Spleen diseased in 126 instances, or in 10·48 per cent. Louis states that in forty-six inspections of enteric fever, in only four cases was it healthy. Murchison also gives testimony of its frequent affection in this form of fever. Birch-Hirschfeld says that in enteric fever Spleen tumor is generally most marked in the second or third week. In relapsing fever Cormack says it was congestively enlarged in a great number of cases. Warburton Begbie, in his description of this fever, asserts that the organ now spoken of is almost always altered. In an account of relapsing fever which I published in 1847 I then said the Spleen was well-nigh always diseased. In the Russian epidemic of relapsing fever in 1864–65, as described by Tillner, Doubowitski, and Bernstein, it was large. Wunderlich and Steffen thus also speak of it. In the exanthems it is not uncommonly found morbid. In the epidemic of cerebro-spinal meningitis, which occurred in Leipsic 1864–65, and was recorded by Wunderlich, the spleen was found large, with a tendency to hemorrhage in such cases as were distinguished by great exhaustion, palpitation and vomiting.

That diseases of the liver are often followed by lesions of this organ is an acknowledged fact. The splenic vein is one of the great formative trunks of the portal vein, and thus when the circulation of the liver is impeded, there is very commonly, but not uniformly, congestion of the Spleen. Murchison says this result is less frequent than might be imagined; and when the circulation of the liver is mechanically obstructed, he believes the Spleen is rendered large in about one-half of the cases. He believes that the absence of enlargement is consequent on the fibrous thickening or calcification of the capsule, preventing vascular dilatation, or on an excessive drain from the gastro-intestinal mucous membrane by diarrhœa or hemorrhage. The portal system being destitute of valves, the splenic vein has consequently communication with the whole of the portal system. In hepatic disease, and especially when the action of the liver becomes enfeebled, it can readily be comprehended how in a conservative manner the blood can be diverted into the spleen. Of cirrhosis splenic disease is the frequent accompaniment. An undue afflux of blood is sent to and retained in this multilocular reservoir, and such surcharge of fluid is succeeded by its enlargement. Rheumatic endocarditis and organic diseases of the heart, especially of the mitral and tricuspid valves, and of the great vessels, are also to be instanced. According to Birch-Hirschfeld of Dresden,[1] there may be considerable enlargement from uncompensated mitral insufficiency, but as the rule there is no notable splenic increase when there is merely incompetency of the aortic valves. When in acute rheumatism fibrinous depositions have become attached to the valvular margins, and are subsequently disintegrated and carried into the current of the circulation, these broken-up pieces of fibrine are sometimes, in the Spleen as in other organs, arrested in the minute vessels, and by giving rise to capillary embolism set up inflammation. It is now known as one of the advances in modern pathology, though perhaps of less frequent occurrence, that when the edges of the cardiac valves have been rendered rough by the heterologous transformations of age, and when deposits of fibrine from the blood-stream have taken place upon the margins of the valves, some fibrinous pieces may be washed off, and by being transferred to the Spleen, as they are transferred to the brain, the liver, and the kidneys, and perhaps to other viscera, may produce capillary embolism precisely resembling that which occurs in rheumatic carditis. And this order of sequences is doubtless an etiological explanation of those inflammatory patches and purulent collections of smaller or larger extent which were by Louis, Abercrombie, Craigie, and others considered as examples of idiopathic inflammation, and of those consolidations which Rokitansky referred to the doctrine of crasis. Emphysema of the lungs, by producing dilatation of the right cavities of the heart, and consequently hepatic engorgement; interruption to the flow of the catamenia; the suppression of hemorrhoids and of cutaneous eruptions, have long been assigned as causes. Bree gives as a cause depressed circulation from external cold, and he also says the Spleen may be idiopathically affected. Idiopathic splenitis is, however, now a term inadmissible, as its inflammation, when not resulting from mechanical injury, embolism, or from continuity of structure, or the proximity of other inflamed organs and parts, is always preceded by lesion of the circulating fluids. External injuries by falls, blows, or compression may be instanced. Long walks, drinking cold drinks when the body is much heated, sudden chills after perspiration and fatigue, are also causes which may be named.

[1] Berliner Klinische Wochenschrift, Nov. 30, 1874.

General Symptomatology.—When this organ becomes morbidly affected in its acute, subacute, and congestive forms, the predominating indications are a feeling of pain or tenderness, or a sense of weight or oppression in the left hypochondrium, left shoulder, and left side; the breathing is often short or shallow; the patient cannot lie easily on the right side, and not uncommonly complaint is made of fulness and tension, which extend from the left side into the stomach. There may be sympathetic pains which continue through into the back and up into the left shoulder and the back of the neck. Dr. Embleton has published an able paper,[1] illustrated by several cases relative to shoulder-tip pain in splenic diseases. He believes, as before observed, that the splenic nerves are derived from each side of the semilunar ganglion and from each of the members of the par-vagum, and thus by receiving nerve-twigs from each pneumogastric, he says the shoulder-pain of the right side may be accounted for. Grotanelli pointed out the frequent occurrence of pain in the left scapula and shoulder as an indication; Cruveilhier gives much significance to shoulder-pain as a symptom; and Bigsby, Bree, and Copland insist upon the same fact. Of ten cases of splenitis given by Embleton, in six the left pneumogastric was found tender on pressure, the right nerve in two, and both nerves in one example; and this physician says pains in the left loin, left leg, left ear, temple, and left side of the head, from the nervous connections above mentioned, may be symptomatic of splenic disease. And he thus continues: "This shoulder-pain in splenic disease will limit on the left side most commonly, as it does generally in hepatic diseases on the right side, the respiratory movements of the sterno-cleido-mastoid and trapezius muscles, and thus the splenic side of the chest will be kept more quiet than it would otherwise be. When liver and Spleen are both diseased, then both sides may be similarly affected in their movements. The above morbid state of the pneumogastric trunk may and does in its upward course affect various branches, as those of the stomach, liver, heart, lungs, and even ear, giving origin to symptoms characteristic of disorder of one or other, or of more than one of those organs; and an attentive observer may remark that many of the symptoms in cases of Spleen disease are attributable to parts which receive branches from the pneumogastric nerve." These facts are of much importance in judging of the symptoms of subjective character. The condition of the countenance is very indicative of splenic disease, and to the practised eye of those who have seen much of the affection in malarious countries, its presence is recognized almost at a glance. There is a heavy, dull, listless, apathetic expression which betokens that lethargic state of the mind with which the ailment is so commonly accompanied. The face is often of a dirty-ish lemon color, sometimes it looks as if puffed and swollen; the tongue, which is generally more or less coated with a whitish fur, is pale, and sometimes as if transparent; the soft parts of the throat are bloodless and flaccid, and the lips are blanched; the conjunctivæ are of bluish white, and the general facial indication is emphatically anæmic. In the acute stage, and more especially when we have reason to believe the serous covering to be inflamed, the pulse is quick and full, and in some cases it is somewhat incompressible. In the subacute, congestive, and more chronic forms of its lesion, the digestive or assimilating process becomes impaired, there is unusual epigastric fulness, the bowels are confined, the stools are mostly dark and may contain blood, and the urine is high colored. Sometimes diarrhœa sets in, and there may be hæmorrhoidal loss of blood or an increase of uterine discharge. Thirst, anorexia, and elevation of temperature in greater or less degree obtain. In a week or ten or twelve days there is generally some decline, in the acuter forms, of the more urgent symptoms, and the disease becomes gradually resolved, or some sequential event, as suppuration, ensues, when other and more characteristic phenomena are presented. In the subacute, congestive, or latent examples of its lesion, which are far more frequently witnessed, as in those in which its affection is consecutive or the complication of another malady, as in adynamic, simple, or remittent fevers, the symptoms are to some extent—occasionally a good deal—masked by the primary complaints, and it becomes difficult to decide, as to how much of the general disturbance and the more objective symptoms depend upon the specific fever and how much depends upon the disease of this organ. In the chronic forms it has from the earliest times been remarked that there is often a tendency to hemorrhage both from trivial causes and spontaneously, that ulcerated surfaces do not heal as under ordinary circumstances, and that the cheeks and gums sometimes become gangrenous. In females in malarious countries the uterine functions become much disordered in splenic disease.

In reviewing the symptoms of splenic disease, it is all-important to bear in mind what has already been said relative to the position of this organ in the abdomen; and there are conditions and circumstances which, if overlooked, would vitiate our conclusions and give rise to

[1] Brit. Med. Journ. Sept. 19, 1874.

erroneous diagnosis. In deformed thorax, as in rachitic deformity, this organ may be moved from its proper place. When the diaphragm is more concave than natural, the spleen ascends abnormally. In lung emphysema; where tumors are formed in the substance of the diaphragm; in effusion into the left chest, and in encephaloid infiltration into the lower part of the left pulmonary substance, it may be felt at the costal edge when not diseased. It does not normally lie so high up under the chest-wall in children as it does in adults, because in children the diaphragm is not so concave. It may be held as the common rule that when the Spleen can be touched it is diseased. Palpable tumor is the surest sign of its lesion, and our decision should be arrived at from negative as well as positive facts. The neighboring organs should be severally excluded. When the stomach is large and resonant, and when the descending colon and the left arch of the colon are distended with flatus, the examination of the viscus will be more difficult. When the organ is considerably enlarged, palpation and percussion discover diminished resilience. It is then brought nearer to the lower chest-wall and to the abdominal parietes. The practised hand will readily perceive the difference which is given to the fingers, and the dull, dead sound which percussion elicits will at once be recognized. Sometimes when moderately enlarged it is borne obliquely forwards and inwards, and being carried from the chest-wall, percussion discovers little or no increase of the normal area of dulness. When acutely affected, as it often is in a secondary manner in specific fevers and in pyæmia, digital examination readily produces pain; in its chronic enlargement palpation gives little or no pain. When the increase is considerable, its mechanical pressure, as I have seen, by impinging upon the walls of the stomach, is apt to give rise to the frequent feeling of nausea and sometimes to sickness and vomiting. It may, from foregoing inflammation of the diaphragmatic covering and adjacent parts of the peritoneum, become adherent, and when it is thus adherent to the diaphragm it may not descend with the inspirations. From its loose attachments, its smaller size, and its greater motion during respiration, it is less liable to adhesion than the liver. It may also be morbidly united to the stomach when its up-and-down motion is rendered limited. Some pathologists affirm that it is very rarely adherent to the diaphragm. It is sometimes thus attached in chronic tubercular peritonitis.

When the diaphragm on the left side is acutely inflamed, as it sometimes is in pleuro-pneumonia, or when it is the seat of malignant deposit, its impaired functions prevent the rising and falling of the viscus, and its motion may be rendered hardly perceptible or be absolutely abolished. In empyema, when the diaphragm becomes stretched and paralyzed, the same result is observed, and the organ may be thrust down below the costal edge, and thus morbid enlargement be simulated. When its enlargement is considerable, it pushes up the diaphragm, forms a mechanical impediment to the expansion of the left lung, interferes with the action of the heart, and dyspnœa, coughing, and palpitation may become urgent symptoms. When the above-named conditions occur, the physical examination of the thorax will throw much light upon the splenic symptoms. It must be remembered that in some cases of its enlargement it may extend quite down to the pelvis and beyond the linea alba. In leucocythæmia it may attain these dimensions. The feeling which, when enlarged, it confers to the fingers is that of smoothness and resistance, and of being immediately under the abdominal parietes. Its notched and sharp edge, when felt, leaves no doubt as to its identity. When chronically enlarged, the patient's gait acquires a peculiarity; he involuntarily inclines to the left side; he relaxes the abdominal muscles on that side, and accommodates himself to the uneasy feeling which he experiences; and it has been remarked that there is more freedom of motion in the right than in the left extremity. When the disease has long continued there is often a deathly pallor of the countenance, tinged with a greenish hue, and which is peculiar to the diseases of this organ. Sir William Jenner thus speaks relative to the symptoms of splenic affections: "A moderately enlarged Spleen forms a tumor in the abdomen situate on the left side and passing upwards under the margin of the thorax. Even when of moderate size, the tumor lies near the surface, and there is no intestine in the front of it. In these particulars it differs from the kidney. It has a sharp anterior margin, and in this also it differs from the kidney. The anterior margin of the tumor passes from above downwards and inwards. Sometimes, but only infrequently, one or more notches can be felt in this border; when felt the notch is quite characteristic. The lower border of the splenic tumor is rounded: the posterior border is to the left, but not so distinctly as the anterior and lower borders. The fingers can, however, always be passed in behind a tumor formed by an enlarged Spleen. You see the resistance of the Spleen as you pass your hand back and back till you reach the space just outside the mass of muscles that lie in the spinal groove,

and then you find a narrow space where there is very little resistance; the anterior border of this space is formed by the posterior border of the Spleen. Having one hand on the posterior border of the tumor, and the other in the front on the anterior edge of the tumor, you find that it is movable from side to side. You can push the anterior border towards or away from the middle line; you move the Spleen thus when it is enlarged, because it is very rarely indeed closely adherent. You know how loosely the Spleen is attached by the mesentery, and it is infinitely rare for the inflammation of the capsule of the Spleen to be followed by adhesions sufficiently close and numerous to destroy its mobility."[1]

When the left lobe of the liver is enlarged —and it may be enlarged much more than the right, but in nearly all instances where one lobe is diseased the other is diseased also—it may be mistaken for the Spleen. Bright observes that in such cases the margin of the liver may be traced running towards the right side. The enlarged Spleen, it should be remembered, lies anterior to the liver. A deep inspiration will generally solve the difficulty, because the Spleen more distinctly rises and falls than the liver, and it descends lower than the left lobe into the abdomen. In hepatic lesion the common symptoms of jaundice, dulness, and tenderness in the right hypochondrium, and the color of the alvine and renal excretions, will assist in conducting to a right conclusion. Left kidney enlargement may simulate enlargement of the Spleen, and more especially when the former is encysted. The left kidney is placed nearer the spine, it is more fixed, the intestine lies before it, and if the patient is requested to place himself on his hands and knees, the kidney does not drop forward so much as in this position the Spleen will drop forward. In renal tumor, the anterior upper and under borders are smooth; there is no sharp defined edge to be felt as there is in the Spleen and left lobe of the liver. Coughing and deep inspiration do not move the kidney, as they move the Spleen, downwards. In cystic formations and turgid growths of the kidney the tumor can be traced forwards and towards the umbilicus, and if traced backwards the dulness is continuous and uninterrupted towards the spine. The kidney has its seat close to the lumbar muscles; there is no space between it, as there is space between the Spleen and these muscles. In doubtful cases as to whether the enlargement be renal or splenic, the ordinary tests and the microscopical examination of the urine will aid in making a correct decision. In renal disease the pain often takes the course of the ureter, and in the male there is mostly pain in the direction of the testicle. Renal abscess may resemble enlarged Spleen, but renal abscess extends back more completely into the lumbar region; it is fixed, and does not alter its position when the patient is turned on the right side, and it feels tense and elastic to the fingers. Bright remarks that an accumulation of feces sometimes renders the diagnosis extremely difficult. But Jenner says fecal tumors are very rare. They may be most certainly judged of by their altering their position; their configuration, as ascertained by digital examination, varies; sulcated irregularities and depressions can be felt; and the adjacent colon is often tympanitic. There is also often the history of constipation, and of constipation alternating with liquid stools. A dose of castor oil or a large enema will in nearly all cases remove any doubt entertained. Ovarian tumor will be recognized by the ordinary symptoms of that form of disease. In such cases the tumor is first felt lower down in the abdomen, and its enlargement is more rapid. Percussion elicits resonance between the costal edge and the lower defined dulness. When the fundus of the stomach is the seat of cancer, and a large cancerous mass is formed in that situation, the general cachexia, the sickness and vomiting, and the loss of flesh will commonly indicate the malignant complaint. In scirrhus of the omentum the tumor is rough, hard and knotted; it stretches like a flattened indurated mass over the front of the abdominal viscera; it is not confined to one side; it is not traceable up under the costal edge like splenic tumor, and pain and sickness I have known to be most distressing symptoms in cancer of the omentum. Subcutaneous collections of purulent matter over the regions of this organ have been said to resemble splenic enlargement, but their superficial and stationary positions render their true nature distinguishable. Acephalo-cyst hydatids may rise from the Spleen. Such cases are exceedingly exceptional, and when they do occur their elastic rounded, smooth, bossy form will make them known when carefully examined.

General Pathology.—Organic lesions of the Spleen are, in the great majority of instances, secondary or sequential. They arise from some form of inflammation, in many cases as the result of fluxionary or obstructive causes. There may have been less of vital cohesion in the gland or certain morbid alterations in the circulating fluids. From the relaxing and yielding tissues of the Spleen abnormal increase of blood in it is much favored, and when such surcharges have been long

[1] Brit. Med. Journ. Jan 16, 1869.

continued and frequently, repeated interstitial changes are apt to follow. Perversion in the function of the organic nervous system tends to such fluxions in this viscus. Experiment has shown that division of the branches of the sympathetic which go to the organ is succeeded by its turgescence. Dorsdoff and Botschetschkaroff of St. Petersburg made a series of experiments relative to the swelling and contraction of this viscus. They observed all its diameters enlarged when the nerves of the splenic plexus were divided, and that these diameters were diminished when the peripheral ends of these nerves were electrically excited; they noticed the liver to become augmented in volume, denser and of lighter color when the spleen was thus artificially contracted, and that with each of its contractions white blood-cells were discharged into the hepatic blood. It would seem, too, from the researches of these experimenters, that the contraction and enlargement of the organ are, not as Müller and others have maintained, wholly dependent upon vaso-motor function, but also upon the influence of its muscular elements.[1] Such being the effect of cutting off the normal nervous influence, it can be understood when the blood is infected by malarial and specific poisons how contractility becomes diminished and varying morbid processes are instituted. When there is obstruction and closure of the portal vein, as sometimes takes place in hepatic disease, such as in cirrhosis and cancer, or when there are tumors which produce mechanical pressure, congestion of the Spleen may occur in marked degree. In heart and lung disease its enlargement is less common. The parenchyma is less prone to inflammation than the envelopes of the organ; and this fact can readily be comprehended when the structure of the respective tissues is considered. From the statements of Gray and Kölliker the parenchyma is constituted of microscopic fibrous filaments, capillary vessels, pulp-cells, and blood-globules, in various states of dissolution, the pulp-cells resembling the Malpighian corpuscles, only being smaller. The Malpighian corpuscles are imbedded in the pulp, and always attached to a minute branch of an arterial twig, united to its extremity, resting upon a vessel or situated at the angle of division, and are filled with viscid albuminous substance which contains nucleated cells. Such being the minute arrangement of its structure, a considerable and sudden afflux of blood may be accommodated. The first condition of its most common morbid state is that of congestion. Its proper vessels become engorged, the trabeculæ lose their elasticity, the capsule and its serous covering are unduly stretched, and the inflammatory process supervenes. Pemberton vaguely attempted to account for this peculiarity by saying there is a want of proneness in the arteries to take on, as he termed it, the essence of inflammation. In tissues more dense and resisting, the irritation which vascular pressure confers sooner and more demonstratively proclaims the inflammatory phenomena. Bree thinks pyrexia is prevented by the turgid and accommodating qualities of the vessels. In the process of inflammation, its substance is apt to be broken up and the pulp rendered semi-diffluent, being mixed with shreds of trabeculæ and vascular sheaths. The antecedent morbid changes of these more manifest conditions are an occult impairment of the organ's vital endowments, whereby follow excessive interstitial exudation of plasma, which is unsuited to healthy nutrition; the blood-globules become more than normally dissolved, and the fibrine is increased; and perverted nervous action so influences vascular action as to affect the splenic cells and capillaries. There is, doubtless, between the intertrabecular spaces and the vessels some kind of communication not yet understood. The blood constantly passing from these alveolar cavities carries with it cellular elements; but if from any cause the onward flow becomes impeded, there must be morbid increase of the pulp, because the cells are then abnormally accumulated. In certain acute diffusive processes the loss of the natural blood stasis is very apparent. According to Billroth, the ultimate and molecular changes of the Spleen in typhus are very characteristic. In the veins he found a surprising quantity of cells containing from two to six nuclei, the normal cells being greatly diminished. In this disease the Malpighian corpuscles exhibit a decrease of cell formation. The large cells in typhus Spleens diminish relatively with the duration of the fever. In pyæmia and septicæmia the morphological change most usual is tumefaction of the cell elements. In hemorrhagic infarction the venous sinuses are generally discovered in a thrombose condition, the blood-globules being matted and massed together in heaps. In putrid and adynamic fevers it sometimes appears as if the pulp had been abolished and the body of the organ converted into a dark grumous fluid, the coats being loose and flaccid, easily torn, and the contents being readily poured out. Softening and enlargement of the viscus are the constant conditions in malignant fevers. In periodic fevers this soft and deliquescent process not unfrequently goes on into the suppurative state. Pus is then found in a number of small depos-

[1] Med. Times and Gaz., vol. i. 1876, p. 308.

its, or in a single large collection. The existence of suppuration cannot, however, always be determined upon, and it has been present when physicians of great practical acumen have not even suspected it. According to Andral, pus in minute yellow drops sometimes infiltrates the entire substance of the viscus. It is generally of the creamy kind, but Cruveilhier says it is occasionally concrete. When the suppurative result has taken place, the membranes well-nigh always become affected, just as in hepatic abscess the peritoneal tunic becomes inflamed and dissection discovers lymphic adhesions. The organ may thus be agglutinated to the stomach or the colon, ulceration may take place, and the purulent secretion be poured into one of these hollow viscera and be vomited or passed by the bowel. Under the continuous and great tension of the capsule, and when it has been rendered tender by disease, it may give way and the pus be extravasated into the cavity of the peritoneum, when diffuse and flagrant peritonitis is speedily established and death soon follows. Sometimes in acute splenitis adhesion takes place to adjacent parts with little injury or inconvenience.

In more exceptional cases, when the process of inflammation has been protracted, there is an indurated condition not only of the envelopes and the fibrous tissues of the organ, but, also of its parenchymatous substance. This state is mainly caused by the condensation of the coagulated matter contained in the cells. There is abnormal deposition of the lymph, and in such examples the cartilaginous tendency is exemplified in the denser structures. There is hyperplasia of the interstitial connective tissue.

Chronic is of far more frequent occurrence than acute inflammation of this organ, and it is this form which is so frequently connected with intermittent and remittent and also other forms of fever. It is sometimes the consequence of hepatitis, dysentery, chronic diseases of the liver, and more especially, as before remarked, of obstructed portal circulation, and organic affections of the heart and large vessels, and when the natural crasis of the blood has been impaired. In malarious countries it is a malady very frequently presented to the physician, and it is from the accounts of those who have resided in the tropics, and whose deductions have been made from a large amount of experience, that we have the best and amplest descriptions. The chronic may be the result of the sthenically acute form, but such examples are exceptional, as slow and gradual congestion is the common forerunner of the kind of lesion now more particularly considered. The earlier stage of the complaint is often masked by the ordinary symptoms incident to the intermittent or remittent attacks, and in proportion as these diseases are in their course marked by asthenia, the splenic complication is less prominent and less easy of recognition. It has sometimes, when the physical signs have been neglected, made an insidious advancement before detection, and sometimes its lesion has not been discovered before dissection. It may be large, and its lesion obtains when there are no subjective signs. The patient tells you he can lie on either side, takes a long breath without uneasiness, and complains of no dulness or aching under the left chest. The older physicians, who knew nothing of the kind of physical examination now practised, had to depend upon more general symptoms, and consequently they not unfrequently altogether overlooked this viscus. Bree says it may have made great progress before being observed, and that there may be pain with little enlargement, and that there may be great enlargement with little pain, and that the pulse may give no evidence of the malady. Pemberton states that it may be thus diseased without producing any uneasiness whatever. William Hunter, De Haen, Grottanelli, and various Indian authors and more recent writers expatiate on the covert nature of the affection, and lay emphasis upon its insidious character. Being frequently the accompaniment or sequel of intermittent or remittent fever, the severity or mildness of its lesion varies much according to the nature of the endemic influences, the preceding health, and the vital powers of the individual. Enlargement is the most notable of all conditions of chronic splenitis; but this should not be the only object of inquiry, as such condition is but the manifest state of a great and foregoing malady pervading the entire system, and we should give due attention to those antecedent and existent changes by which it is produced. An extraneous and deleterious agent is imbibed into the body, and the entirety of the circulating fluids undergoes a potent and morbid alteration. It may be that the nervous centres are primarily affected, and more especially the nerves of organic life, and that the organ which, as it has already been said, is so importantly, so eminently concerned in the evolution of corpuscular germs of the blood, may in greater degree than in any other organ be impressed by the poison. Other poisons, which give rise to specific fevers, exemplify their peculiarities in affecting certain and distinct organs and tissues; and the cause of their diversity of action can only be in certain subtle and essential differences in the primary and extrinsic agent. Accompanying the chronic ailments now considered are great debili-

ty, languid circulation, deficiency of red-blood globules, and a yellowish, pallid unhealthiness of aspect. The expression is dull, the mind apathetic; in addition to the dirtyish lemon hue of the skin, the facial integument is sometimes puffed and bloated, the eye looks clear and blanched, the lips, tongue and fauces are typical of anæmia. Muscular debility and general inertness are apparent, and in this lowered condition the functions of respiration, assimilation and secretion become gravely affected. That hemorrhage, dropsy, or gangrene, should sometimes follow the train of morbid processes now instanced cannot be surprising. Such depravation of the fluids is inevitably succeeded by more obvious and pronounced pathological changes. Cullen had long ago pointed out how the kind of splenic affections now more particularly referred to may end in resolution, suppuration, or gangrene. It has been stated above that chronic splenitis may come on without subjective symptoms, and it sometimes happens that it may make very slow progess, and with little or no suffering. In other instances there is some discomfort from tumid belly and difficult respiration; and there may be alternative periods of improvement and remissions of an aguish character for many months, or it may be for years.

In certain examples of excessive splenic hyperæmia, and when the fluxionary surcharge of the organ has been sudden, the symptoms of anæmia quickly supervene, and more speedily than could be looked for in any general blood change. The temperature may, as it frequently does, rise high during the intermittent paroxysm; but it may be equally high in continued fever, and the tissue oxidation and blood consumption be as great; but the symptoms of anæmia are far more emphasized when the periodic type has preceded. Mechanical causes doubtless explain this peculiarity. The symptoms of bloodlessness are produced relatively in rapidity and degree with the suddenness and extent of the splenic enlargement. Such a congested condition of this organ means really the abrupt and temporary withdrawal of a large quantity of the vital fluid from the system. If the hyperæmia quickly decrease, the anæmic symptoms also begin to disappear, and with more quickness than would be the case if such depended on the improvement of impoverished blood. A general amelioration in the circulating fluids would require far more time. The experiments of Greisinger have shown the correlation which subsists between these symptoms and the rapid enlargement of the viscus. The fluxionary hyperæmia incident to the respective types of continued fever is neither so excessive, nor does it produce the kind of symptoms now particularly considered. When the forms of continued fever have run their course, and convalescence succeeds, the organ is restored to its normal condition. In remittents it is not so, and more especially if the paroxysms have been often repeated. Continued tension effects alteration in fibroid and vascular structures, and augmentation of volume follows.

The morbid condition of the blood which is now known as melanæmia is doubtless referable to an abdominal process carried on in this viscus; for nearly all observers now regard the spleen as the place where the pigment is formed in the melanæmic dyscrasia under the influence of the malarial cachexia. The German pathologists were the first to investigate this subject, and prominently point out the manner in which the pigment is formed in pernicious intermittent fever. According to Rindfleisch, pigmentary particles are discovered floating in the blood. Their shape is irregular; they may be yellow or brown, but are more commonly black granules; as the rule, they are smaller than the blood-corpuscles, but a few may be seen which are of larger size. Some are spindle-shaped corpuscles, others are round, and the particles of free pigment vary in their physical configuration. Trousseau, in speaking of this pigment, says it is mainly formed of granules which are amorphous, sometimes irregularly agglomerated, and sometimes cylindrical, from having been moulded in the interior of vessels. The product now spoken of is consequent on the transformation of hæmatine. The tradition that black substances are generated in the spleen and blood is one of the oldest doctrines in the history of medicine. From the days of Galen to the times of Van Helmont, Sylvius, Boerhaave, and Van Swieten, the cause of this condition was under various theories discussed. Certain of the ancient writers were of opinion that the fluidity of the blood under particular and specially perverted processes in the organism was diminished, and that a black and condensed product resulted; and some enunciated the notion that the more solid character of the new substance gave rise to mechanical obstruction in the viscera, and more especially in the brain, and thus were accounted for those grave effects of which it was the forerunner. It was the doctrine of Hippocratic humoralism still maintained, but under particular modifications. Kämpf added to atrabiliary matters other substances produced in the plasma of the blood. Reil in the last century opposed the ancient notion of the physiological effect of black bile, and subsequently Heusinger and Puchelt attributed pathological phenomena to the deposition of a black pigment. Lancisi and Stohl had long before noticed a dark tinging of the

skin and black deposits in the brain of those who had died of malarious fever; and, coming down to later times, Bailly, Bright, Annesley, Haspel, and Stewardson commented upon this morbid condition. In 1837, Meckel fully and satisfactorily ascertained that this dark coloring of organs and tissues depended upon pigmentation derived from the blood, and he was of opinion that the pigment formed in this gland passes into the portal blood, that the larger particles are detained in the hepatic lobular zones, and that the finer particles pass through the liver to be transferred to various parts of the body. The blockage which it effects has been called microscopic embolism. Virchow, Heschl, and Planer more recently gave illustrative examples of this now commonly received fact. The spleen is the organ where the pigment is manufactured, and more especially when that organ has been repeatedly and excessively congested. In the stasis of hyperæmia the blood-globules are decomposed and their hematine becomes transformed into pigment. It is then carried into the vena porta, into the liver, the vena cava, and into the heart, thence to be diffused into the general circulation. Some American observers have known pigmentation confined to the portal blood. The malarial poison causes splenic hyperæmia, and consequently extensive destruction of red-blood corpuscles. Frerichs says, in the hyperæmia of the spleen, consequent upon intermittent fever, the stagnation is exceedingly great, and as a result the formation of large masses of pigment. This writer also believes that, in exceptional cases, the liver, and not the Spleen, may possess the capability of making pigment. He gives a case in which none was discovered in the spleen, but in which much was detected in the liver. As the melanæmic dyscrasia is not always observed in splenic enlargement consequent on pernicious intermittents, and as occasionally pigment is present when the hyperæmia is not excessive, a mere mechanical way of accounting for this result can hardly be admitted. It is exceedingly presumptive that the marsh miasm under certain conditions and in certain epidemics causes excessive necrosis of red-blood corpuscles. The relative virulency of poisons will determine the degree of necrotic power, but of the altered physical conditions giving rise to such effects we have no means of judging. The experiments of Virchow lead him to believe that in great destruction of the blood-cells in the spleen the hematine passes into the colorless elements of the spleen-pulp and by this means enters the blood. This writer is also of opinion that the bright substance adhering to the pigment granules consists of the protein matter which was combined in the fibrin of the disintegrated corpuscles. Rindfleisch says pigmentation occurs in the intervascular cords of the spleen-pulp where the blood flows most slowly; and as the intervascular cords are not shut off from the cavernous veins by an impermeable membrane, filtration goes on between the arterioles and the venous radicles, and in this way pigment flakes pass into the blood. In those organs in which the capillaries are the narrowest pigment deposits are most marked. It is thus that black matter is so frequently discovered in the brain. The retia mirabilia of the kidneys are unfavorable to the passage of these particles, and thus the kidneys next to the brain are most liable to melanæmic pigmentation. Such being the obstructive qualities of this product, the pathogenic theory has been promulgated that the graver symptoms of pernicious fevers may be attributed to pigmentary embolia. Extensive destruction of blood-globules from the cause now described must necessarily be followed by a general impoverishment of the blood, and thus in marsh fevers, anæmia; hence that peculiar color of the face in malarial cachexia, and which is so characteristic of chronic disease of the spleen. In well-marked cases of pigmentation the spleen is discovered of dark brown or bluish black color; which may be uniform or the parenchyma may be speckled. The organ is then soft, congested, and generally enlarged.

There are two morbid states incident to this viscus from morbus cordis, which exhibit different diseased conditions. In cardiac ischæmia the organ becomes dark, and it may be somewhat indurated, and the entirety of the parenchyma assumes that alteration of color and consistency. In that infarction which is preceded by inflammation and ulceration of the endocardium, and therefore in connection with blood changes, defined patches are seen on the surface which are paler than other parts of the capsule, and which patches on section are wedge-shaped, the apex being in central direction, the base at the surface. The arteries supplying these circumscribed spots have been found blocked by ante-mortem clots. The vascular walls at length give way, blood is effused into the circumjacent substance, or the limited areas of such extravasations assume something of that apoplectic character which is known from a like cause to eventuate in the pulmonary parenchyma. Absorptional wasting, the formation of pus, or capsular peritonitis are apt to follow. It was the opinion of Rokitansky that the chief diseases of this viscus arise from anomalies in the blood and serum, or from certain dyscrasiæ, not well understood, yet which bear a remarkable and positive relation to the spleen. When speaking of secondary

splenitis, caused by the absorption of poisonous inflammatory products, or affected in an analogous manner spontaneously, and showing the delicate reaction of this organ upon a morbid state of the blood, he says the formation of inflammatory spots is in every way remarkable. They are well defined, and occupy the peripheral portion of the organ, presenting a cuneiform shape, the base being at the surface and the apex pointing towards the centre. That author considers this form of its inflammation to be identical with pyæmic deposits, and to consist of the metamorphosis of an infected coagulum, within the channel of a vascular ganglion. These fibrinous blocks, to which reference has already been made, like apoplectic extravasations, have a tendency to deliquesce; but when they originate from cardiac emboli, as they sometimes do originate in this organ, there is not that proneness to rapid softening and disintegration which there is when pyæmia is the cause. The sudden arrest of nutrient blood to any particular area, as shown by Cruveilhier and Wharton Jones, at once produces capillary congestion, which is followed by the consequential and more cognizable phenomena of inflammation. Kirkes and Virchow pointed out that detached fibrinous vegetations in cardiac disease, and most especially in endocarditis, are swept on in the current of the blood until they block up an arterial branch, or it may be several branches, in some distant organ, as the brain, the lungs, the liver, the kidneys, or this viscus. Sometimes embolic infarctions have been found where no conditions could be detected to which the causation of emboli could be referred. The so-called arterial thrombosis might be the cause. When no valvular roughening nor any acute cardiac disease has preceded, ante-mortem coagula, from long enfeebled heart's action, might, as some pathologists have suggested, give rise to the phenomenon now more particularly considered. When these fibrinous pieces were deposited in the kidneys as the consequence of emboli or acute rheumatism, Rayer regarded the morbid condition as that of rheumatic nephritis. That which Rokitansky looked upon as capillary phlebitis is embolism, and the cuneiform blocks, when unassociated with greater evidence of pyæmia, may correctly be attributed to fibrinous obstruction. Dr. Wilks had under his care a young man in Guy's who died of ulcerative endocarditis. On examination after death, the Spleen was discovered to be covered with lymph, which was evidently of recent formation. On section, the organ was seen to contain large abscesses of greenish glutinous pus, and which did not resemble softened fibrin, and the arteries running into the abscesses had plugs of the same granulation-like substance which was found in the mitral valve. The Spleen is not the usual seat of pyæmic suppuration, but is more frequently the place where emboli give rise to the suppurative process when caused from cardiac disease. Sometimes it is difficult to say whether such depositions come from a pyæmic or an embolic cause. There is no doubt, also, that fibrinous clots may be produced in the arterial branches themselves, and that such pieces may plug up vessels of smaller calibre, and the same morbid results obtain. The consequences of thrombosis and embolism are on the whole very near by the same, if not identical with those pathologic changes which obtain in secondary pyæmia. Still there are distinctions between these affections. In pyæmia there are generally purulent deposits in some other parts of the body, and not unfrequently the affection is obviously referable to a localized cause. There is, also, great tendency to suppurative decomposition. The proneness to destructive and degenerative change is more apparent than in mere embolia. When in secondary pyæmia the Spleen is affected, the morbid conditions which inspection reveals are dark circumscribed extravasations of blood, which are of apoplectic character; they exhibit a great tendency to break down and degenerate into puriform collections, and there are generally some small abscesses to be found in the parenchyma. Murchison reports a case of embolism of the viscus produced by enteric fever, and in which dissection revealed two yellowish wedge-shaped deposits of the size of chestnuts, and he asserts that this kind of deposit is the most common in the Spleen as the result of enteric fever. This physician also describes the same kind of pathologic appearance as following relapsing fever. A young man aged twenty died of this type of fever, and his Spleen was found to weigh thirty-one ounces. The organ was soft except at either end, where there was a firm pale mass as large as a small orange, and exactly like the masses ascribed to embolism.

There is doubtless some similarity between the condition of the blood in scorbutus and in chronic splenitis. In both forms of disease the cicatrices of ancient wounds and old ulcers are apt to break open, and cutaneous injuries are difficult of healing. Graves mentions the tendency of chronic splenitis to give rise to suppurative ulceration of the legs, and he quotes from Aretæus, who in his time had not failed to observe the same peculiarity. Voight affirms the same to obtain in Bengal. The latter records that blisters and even leech-bites produce phagedænic ulcers which run on to a fatal termination. Twining gives similar testimony. He

says patients are prone to sloughing ulcers from slight wounds and bruises; also that those peculiar characters of active inflammation,—and that constitutional energy on which the deposition of coagulable lymph depends, and by which we find injuries repaired, and the extension of ulceration as well as the progress of sloughing arrested on ordinary occasions,—seem to be in a great measure, if not entirely subverted. He remarks, too, that the blood drawn from patients coagulate imperfectly, and that the crassamentum was not unfrequently black and soft without exhibiting the buffy coat. On this particular Sir Ranald Martin thus writes:—"A wound or trifling abrasion, which at another time would escape notice, now becomes a foul and sloughing ulcer, owing to the depraved state of the blood, and the generally diseased state of the system; hemorrhages arise from slight causes, sometimes spontaneously; and so altered is the character of the blood, from the want of red globules apparently, that when performing surgical operations of immediate necessity at the Native Hospital of Calcutta, I always became aware of the presence of splenic disease on making my first incision, the hue of the blood being demonstrative of the fact." Muscular debility, impairment of the respiratory and assimilative functions, dropsies, and gangrene of the cheeks and gums, are the not uncommon associations of such depraved condition of the circulating fluids.

There is a large class of diseases of acute forms, which are not localized, in which the entire mass of the circulating fluid undergoes change, and in which, as above observed, the Spleen in greater or less degree becomes implicated. In specific fevers such is eminently the case. Some morbid materials, it may be the matter of contagion, some miasma or virus, is imported into the system; it is infinitely multiplied in the blood, and certain constituents of the blood undergo transformation; and in such diseased condition of the circulating fluid new morbid products also become added to it. In the various kinds of continued fever, in the exanthems and periodic fevers, such changes very largely enter. Certain of the German pathologists have latterly attributed much importance to splenic enlargements when associated with acute febrile affections; and they regard such enlargement as an objective and a prominent fact which ought to count for much in the formation of diagnosis. Sir William Jenner, in this country, has also insisted on the same fact. Friedreich of Heidelberg is of opinion that the tumefaction of this organ in numerous acute febrile diseases cannot satisfactorily be accounted for on the assumption of simple fluxion, and he says we must look for other causes for the great hyperplastic proliferation which is, under such circumstances, not unfrequently present in the pulpous elements of the viscus. In the class of cases now particularly instanced, there is, doubtless by the importation of foreign matters into the blood, special irritation instituted in the splenic pulp. This writer insists that such changes of volume in the Spleen would often justify us in deciding as to the infectious nature of a malady when the etiology might be otherwise obscure. He goes on to say, "The readiness with which the Spleen reacts to certain substances of an injurious nature present in the blood is explained, not only by the copiousness of its blood supply, but also by its anatomical peculiarities. We know that the arteries in the interior of the Spleen break up into very numerous, extremely fine branches and capillaries, perforated by stomata, that the blood passes from the vessels into wide spaces destitute of walls (the intermediary blood canals), from which the veins begin to arise in like manner, principally as cribriform canals. The blood flows with extreme slowness through these wide intermediary canals, and both here and in the cribriform perforations of the capillaries is in intimate connection with the lymphoid cells so susceptible to irritation, and the delicate, fibrous network of the pulp. Hence it follows that matters of an injurious nature infecting the blood are extremely liable to be retained in the Spleen, to accumulate therein, and to act with peculiar intensity as excitants to the splenic tissues." The authorities on this subject point out with much assurance the regular occurrence of splenic tumor in enteric fever. In doubtful cases of enteric they would regard this physical sign as decisive of the diagnosis. Türgensen, in what he terms *typhus levissimus*, looks upon the presence of splenic enlargement in doubtful cases as sufficient, in conjunction with other symptoms, to indicate the true nature of the primary malady. It is not, however, supposed that there is an exact correlation between the augmented volume of the organ thus increased and the gravity of coexistent febrile phenomena. The Spleen, they say, may be large in the mildest forms of enteric, and only moderately augmented in the severest examples. The resisting power of the constitution against the irritative properties of the contracted infectious matter, they affirm, will account for this disagreement in the greater or less obstructive effects, and the more pronounced or moderate hyperplastic turgescence. The Spleen, it is said by the authorities to whom reference is now made, thus becomes acted upon at the

very outset of the enteric attacks, because the specific poison of that fever has a remarkable tendency to morbidly influence this viscus. Some of these writers aver that splenic tumor supervenes even during the incubative stage of enteric, and that it is the last amongst those organs usually affected in that complaint which returns to the normal size and condition. And relapses in enteric are said to be more probable when, during convalescence, the Spleen is slow in its diminution. Sometimes the swelling will be to such an extent that it will project to a considerable distance below the costal edge. It is to be held in mind that on making an examination of the state of the Spleen in enteric fever much fallacy may result from the condition of tympanitis, and there may be decided enlargement, whilst the region when percussed is resonant. Careful palpation is then our safest guide. Türgensen says enlargement of the Spleen occurs probably in all cases, and is a constant symptom even of the mildest enteric. Out of eighty-eight cases, in seven only was enlargement not recorded; hence it was recognized, therefore, in ninety-two per cent., and, he remarks, it was often demonstrable very early, not rarely on the second or third day of the disease. Sometimes a long period elapses before the hyperplastic elements undergo solution and absorption, and before the contractile functions of the organ became fully restored; and such tardiness in a return to the normal configuration is doubtless not only dependent upon the presence of new materials thrown out, but also consequent upon the grave impress being made by the specific poison upon the splenic plexus. In diphtheria, as in enteric fever, the Spleen is said not uncommonly to be increased in its diameter. Birch-Hirschfeld says splenic tumor occurs as the rule in hemorrhagic variola, and Trojanowsky attests to the same coming on in scarlatina and measles. In the first-named he had several times been able to demonstrate clearly the existence of a splenic tumor in the irritative stage, and in the majority of instances after the appearance of the eruption. During an epidemic of measles which raged in Heidelberg in the winter of 1873-4, Friedreich repeatedly convinced himself of this complication in that exanthem. In erysipelas, in acute coryza accompanied with febrile phenomena, and in that masked, wandering, and which has been termed serpiginous form of pneumonia as contradistinguished from the better defined and more recognized croupous inflammation of the lungs, these physicians affirm that splenic tumefaction is usually to be discovered, and that the proneness of this viscus to exceed its natural size in these respective ailments affords proof of their primarily infectious character. If the foregoing statements, which these writers have with such prominence put forth, are found to hold good as the rule and not exceptionally, splenic tumor would often and very properly be sought for as an aid to diagnosis in many otherwise ambiguous instances of infectious diseases. During the first six or eight days after the invasion of enteric fever, when the true nature of the complaint sometimes puts on such conflicting appearances, and when there often is to the most experienced eye so much difficulty in its recognition, an additional fact like that now spoken of, to aid in our decision and direct our judgment aright, would be of the greatest value. "I feel convinced," says Friedreich, "that a careful consideration of the condition of the Spleen would enable us to recognize the infectious nature of many disorders which present themselves as apparently merely local affections, and that the group of the acute infectious diseases would be thereby considerably increased." That the Spleen is frequently involved in the various forms of febrile affection, and to a greater extent than was formerly supposed, can hardly be disputed, but that it is so very commonly the seat of lesion, as these pathologists insist upon, requires still a greater accumulation of proof.

If the endeavor were made to enter into an explanation of these etiological conditions whereby the Spleen is so prone to become the seat of lesion in various infectious diseases, such would be to discuss the fundamental agencies of contagion and miasma, and in much that could be advanced to pass into the dubious domain of hypothesis. Late investigation has, however, elicited not a little which seems in no slight degree to harmonize with theories which have long been put forth, and which have been believed to be explicative of clinical phenomena. If we are to endorse the notion of attributing to the origin of many acute infectious ailments the absorption of a *substantia viva* into the body, the primary blood contamination can then be understood. The more recent researches of pathology tend to give credence to the supposition of minute low vegetable organisms constituting the cause of that class of diseases to which reference is now particularly made, and this view in some degree gives confirmation to the doctrines which found favor with the older physicians, and who held the idea of a parasitic origin of diseases. The generic group of these organisms which has been named schizomycetes is said to possess species called bacteria, bacteridia, vibriones, spirillæ, and other distinguishable kinds of minute entities, and it has been imagined that each of these microscopical organisms gives rise

to a distinctive train of morbid actions. Davaine showed malignant pustule to be preceded by bacteridia in the blood; Klebs believed from certain experiments that the microsporon septicum could cause continued fever; and Letzerich has maintained that the schizomycetes discovered in the blood in diphtheria are peculiar, and differ from the other and recognized forms of those in the lowest types of animal life. If, then, acute infectious diseases are to be referred back to the presence of varying and dissimilar microscopic organisms, much light may be said to be thrown on the origin of what is termed the great class of zymotic diseases, and which destroy a sixth part of the population. It is the opinion of those investigators who have closely studied this subject, that morbid phenomena are not to be referred merely to the presence of these corporeal particles in the blood and their mere physical effects, but rather to the irritating virus which they secrete, and the power which such virus possesses of instituting diseased action; again, they may, it is possible, abstract from the blood certain constituents essential to nutrition and the normal forces of vitalism, and hence another cause favoring morbid processes. The function and nutrition of organs and tissues having become implicated, a greater or less amount of disorder would be given to the general system. And as it has been said that some particular parts are more liable to become the habitation of schizomycetes than other parts, a local prominence would thus be conferred to the disease. The vascular apparatus of the Spleen has been said, as above remarked, to favor the concentration for these minute and organized germs. Coze and Feltz in smallpox detected the largest number of bacteria in the Spleen; Birch-Hirschfeld saw micrococci in large accumulation in that organ; and Grimm discovered in animals, which died from malignant pustule, bacteria very numerously in this viscus. If the views above cited are to be accepted, and if these organic particles largely accumulate in the Spleen, then their poison would also be concentrated in the protoplasm of the cells of the pulp, and thus an explanation is afforded of the early manifestation of splenic tumor, and, too, a reason is given why this organ is slow in its return to a normal state.

In pyæmia, icorrhæmia, and septicæmia, and in purpura and scurvy, lesions of the blood constitute the cardinal symptoms. In nearly all, it may perhaps be said in absolutely all, of these named, there is decrease of fibrin and excess of red-corpuscles, and, as a consequence, one or other form of hemorrhage often comes on. When in these complaints this organ is in secondary manner affected, and its congestion gives rise to hemorrhage, the loss of blood may be from epistaxis, or hæmatemesis, or by the passage of blood by the bowels. The tense and fibrous tunic of the viscus prevents its being relieved by serous exudation, as the lungs are relieved by effusion into the pleura, the peritoneum by ascites, or as a congested liver and a congested gastro-intestinal surface are relieved by serous diarrhœa. Sometimes the hemorrhage by epistaxis, or by hæmatemesis, may be to an alarming degree or it may be fatal. A young man of pallid and anæmic aspect was some time ago admitted into the Tunbridge Wells Infirmary under my care. He stated that he had gradually lost flesh and strength, and that he had been obliged to relinquish his ordinary employment, which was that of a farm-servant. He was twenty-two years of age, the physical signs of the thorax were normal, there was no hepatic enlargement nor had he ever been jaundiced. On careful examination the splenic dulness far exceeded the normal area, the edge of the organ could be felt depending below the left cartilage, and it extended horizontally nearly to the mesial line. I carefully mapped out the lines of dulness on his admission. He was treated with iron, sulphuric acid, and bitter infusions, the bowels being moderately acted upon by aloetic purgatives. He was discharged at the end of a month, looking and feeling better, and on percussion the splenic dulness occupied a decidedly diminished space. After having left the institution ten days profuse loss of blood came on from the mouth and nose. The hemorrhage continued at intervals during the three succeeding days. He lost two quarts of blood, and sank from exhaustion. Sir T. Watson says he has more than once seen hæmatemesis in connection with splenic enlargement, and he quotes from Morgagni, who relates a case wherein, after repeated attacks of hæmatemesis the patient sank, and on cadaveric inspection the viscus was found to weigh five pounds and to be gorged with dark blood. He also cites from Frank, who gives the history of a patient who had vomiting of blood, and the organ weighed sixteen pounds. That case had, however, evidently been one of leucocythæmic enlargement, as we now know that in white-globule hemorrhage is liable to occur. Latour gives several cases which he had selected from various authors, in which splenic enlargement was followed by hæmatemesis. An illustrative example of that which is now asserted lately occurred to me. A lady who has a very large Spleen which almost fully occupies the left hypochondrium, and the anterior edge of which extends to the median line, and whom I now professionally see from time to time, had

several times a terrible attack of hæmatemesis. She then lost within twenty-four hours between five and six pints of blood, and the exsanguination became so extreme that she had syncope. From my first acquaintance with this patient she looked pale and anæmic, and there were all the external appearances of splenic disease in addition to the more conclusive testimony of markedly existent physical signs. The hemorrhage has not returned. This large loss of blood seemed for a time to render the tumid spleen of less volume.

This gland, as before remarked, is very importantly concerned in the formation and disintegration of blood-globules, and if the chemical constituents of the blood are changed, it cannot normally perform its office, and as a consequence must necessarily of itself become diseased. Its enlargement and loss of vital adhesion are its most common alterations.

Acute Splenitis.

There may be acute inflammation of the Spleen, as there may be acute inflammation of any of the other solid viscera, but the true sthenic type very seldom occurs, at least in this climate. In malarial countries it is not so uncommon, and more especially in tropical regions. When it is observed in this country it is generally referable to the extension of the inflammatory process by continuity of structure and proximity of position, as when the serous coverings of adjacent organs and parts are inflamed; or it may be produced by external violence. From such causes it may obtain at any age. M. Huguier gives an example of acute splenitis in a child not four years old.

Causes.—In addition to the causes already named, sudden distension, and stretching of its fibrous capsule under the malarial influence; exposure to a lowered temperature after hot and sunny days; long and fatiguing marches; great bodily exertion, such as protracted journeys in damp and marshy districts; hemorrhagic infarctions as connected with hyperæmia; emboli originating in left heart valvular disease; and the suppression of accustomed discharges as hæmorrhoids and the catamenia have been regarded as the etiological conditions. Long says inflammation of the uterus has been found to be succeeded by acute splenitis. Hemorrhagic infarctions occurring during the progress of infectious diseases sometimes constitute a cause. Intemperance may also be named.

Symptoms.—According to Grottanelli, Bree, Craigie, and others, acute splenitis is ushered in by shivering and chilliness alternating with flushes. There is a sense of tension, weight and dragging in the left hypochondrium; pains are felt deep in the side, sometimes of sharp and stabbing character, which radiate into the epigastrium, or round to the spine, or extend to the left shoulder, breast, and clavicle. Sickness and vomiting may supervene, the ejected matters being a biliary mucous fluid and occasionally mixed with blood. Sometimes the blood vomited may be large, and when there is sanguineous extravasation into the stomach the stools are necessarily darkened. There may be some hæmoptysis or epistaxis. Twining says that inflammation of the serous coat sometimes takes place without much enlargement of the viscus and that the symptoms greatly resemble those of pleuritis. If the peritoneal covering of the diaphragm be involved, cough and dyspnœa are prominent symptoms. Thirst, loss of appetite, furred tongue, confined bowels, scanty urine, heat of skin, and flushed countenance obtain, and in the evening the general conditions of pyrexia assume more or less of exacerbation. Sometimes hiccough, tympanitis, diarrhœa, delirium and exhaustion come on, and the patient will die in the course of a week or ten days. The pulse is quicker than natural, but its acceleration is not always in a ratio commensurate with the severity of the concomitant symptoms. The pulse may not exceed 90, and the temperature be only 100° F. even when the case is progressing to a fatal termination. Sudden and diffuse peritonitis may come on when all the cardinal symptoms rapidly become more grave. Certain of the older writers have endeavored to account for the comparatively slow pulse by attributing such peculiarity to the distensile and accommodating qualities of the organ, by which they conceived it to be less prone to vascular obstruction and blood stasis, the notable conditions of inflamed parts, and which so potently react upon the circulatory and nervous systems. The patient cannot lie on the right side, and whenever he attempts to do so the dragging pain is much increased. When purulent formations take place there are rigors and flushings, and a throbbing in the splenic region, and the patient lies partly on the back and partly on the side. In the worst cases of acute splenitis there may be black stools, these being voided unconsciously. In those examples which pass on to a favorable termination there is the gradual mitigation of pain; the patient is by his feelings less restricted to one position in bed; the breathing is easier; the pulse and temperature begin to fall; there is not uncommonly a copious perspiration; deposits are seen in the urine; diarrhœa may come on; the

tongue is more moist and less furred; sometimes there is some loss of blood by hæmorrhoids; and in females the catamenia may appear; the evening exacerbations are not so pronounced, and the sleep is more continuous. In the course of a few days after such decline of the more prominent symptoms the physical signs likewise indicate improvement.

Diagnosis.—When the inflammation of the peritoneal covering has been established the fibrous capsule and the substance of the organ also become affected; there is then some enlargement, and palpation will generally discover the lower edge of the organ ranging with or depending below the costal cartilages. The complaint may be distinguished from hepatitis from what has been above said relative to the physical signs, and accurately observing the seat of pain; by the absence of jaundice and the color of the excretions; from inflammation of the stomach, by the sickness not being a cardinal symptom; by pressure being borne at the epigastrium, and by remembering that idiopathic gastritis is very rarely seen in this climate. It may be known from pneumonia and pleurisy in the lower half of the left thorax by the non-existence of those stethoscopic signs so characteristic of the respective affections; it differs from nephritis in the locality of the pain, by its not following the course of the ureter, by their being no retraction of the testicle, and by the analytical and microscopical appearance of the urine; and from ordinary peritonitis by the clinical history of certain negative facts, by the state of the pulse, and the tenderness not being diffused over the abdomen. Its resolution is judged of by freer flow of urine, moist tongue, improved circulation, less pain, cooler surface, and the more natural appearance of the features.

Treatment.—In those cases which may be regarded as being of the sthenically acute type, when the vital powers are unimpaired, as evinced by strong and quick pulse, heat of skin, thirst, furred tongue, accelerated breathing, cough, and pain on hypochondriac pressure, local blood-letting may be employed. If the tenderness be not too great cupping may be had recourse to, but if the local pain be considerable leeches should be ordered. The part having been then well fomented, a large linseed-meal or bran poultice should be applied; this should be covered over with cotton-wool, and then a piece of oiled silk should be placed over, extending fully beyond the margins. The fomentations may be with poppy-head decoctions. In some cases terebinthinate epithems are of great service. When the acuter symptoms and the symptomatic fever are subdued, stimulating liniments, blisters and moxas are of use. Aloes, antimonials, and neutral salts are at the first beneficial. Afterwards the compound extract of colocynth, the compound jalap powder, and various preparations of senna, scammony, or rhubarb are appropriate remedies. Mercurials should except occasionally in union with purgatives, be avoided. When there is sympathetic vomiting the carbonates and bicarbonates of the alkalies may be administered. A carefully regulated diet and rest in the recumbent posture should also for some time be observed.

Chronic Splenitis.

There are many indications in common to both the acute and chronic forms of the disease. In chronic splenitis the degree or intensity of the affection is most varied. It is generally the complication of ague, and is most frequently observed in the malarious districts of the East. It is often a consecutive complaint, and is seen mostly in conjunction with intermittents and remittents, or as associated with hepatitis and dysentery. In the continued fever of this country it is occasionally noticed concurrent with or as the sequel of that disease. The more obvious conditions of its covert or low form of inflammation are sometimes preceded by congestion. And the acute inflammatory state may be succeeded by the chronic. In some instances the envelopes become inflammatorily affected, when degenerative products may in the course of time be found in the tunics, as the cartilaginous or ossific conversions; or greater or less amounts of purulent secretion may be formed in its parenchyma.

Causes.—The causes of chronic splenitis are those etiological conditions which have already been spoken of when treating of the etiology of splenic diseases generally. By far the most common cause which can be mentioned is the endemic influence, and most especially the malarial exhalations which are so usually given off in fenny districts and in tropical countries. In the East and West Indies, and in other of our colonial possessions, where intermittents and remittents are so commonly met with, this affection is very prone to occur, not only in the white but in the dark races, and particularly among young people, and in the children of European residents. The fluxionary hyperæmia to which this gland is subject in periodic fevers, and the repetition of surcharges of blood, induce a proneness to a low form of inflammation in its structures, and the inflammatory phenomena thus

set up are often insidious and protracted. The more cognizable conditions of the sthenic or acute affection may as remarked become chronic. In the various forms of continued fever this organ may in consecutive manner become chronically inflamed, and in the relapsing type this observation more especially holds good. In the organic changes of other organs this gland sometimes becomes chronically inflamed. In cirrhosis of the liver, and where from any other cause there is obstruction of the portal vein, such may be the case. Wherever circumstances may obtain which mechanically obstruct the hepatic circulation a low state of splenitis may occur.

Symptoms.—The more prominent symptoms are a feeling of weight and heaviness in the left hypochondrium, which is aggravated by lying on the right side. There is uneasiness on pressure over the region. The patient describes the pain as dull, obtuse, and aching, and it extends, as Morgagni observed, towards the spine. There is a distressing sense of fulness and tension at the epigastrium, which is more prominent and rounded than normal. The sleep is broken and fitful, and disturbed by unpleasant dreams; there is more or less of dyspepsia, and there is often a light-colored glassy tongue; and when the diaphragmatic covering is affected the breathing is hurried and shallow, as in the acute types; added to which there is a dry, teasing cough, and there are also anorexia, flatulency, torpid bowels, scanty urine, dry skin, and furfuraceous desquamation of the cuticle; and acceleration of the pulse comes on more towards the latter than the earlier stages. This, however, is not an invariable symptom. Bree says the pulse is slow during the earlier or congestive stages, and only becomes quick when the tunics are at length painfully distended; he also adds that the gland may for months be turgid without giving rise to symptomatic fever, and that a moderate degree of fever is indicative of an effort on the part of nature to resolve the disease. In the evening, or during the night, there is exacerbation. In this condition of the organ, blows, falls, and external injuries are apt to be followed by acute splenitis. When the complaint is of long continuance, when it passes into what may be termed the third stage, when remedies have proved inoperative, and when change of climate cannot be obtained, still graver conditions become apparent. There is then increased debility, the legs are smaller, the loss of flesh is more marked, convulsive asthmatic attacks supervene, and the enfeebled heart is exemplified by fits of palpitation which follow exertion. The organ extends below the false ribs, and often obliquely towards the umbilicus. The anæmia, blanched sclerotic, and tawny countenance proclaim augmented deterioration of the circulating fluids and depressed secretion, whilst the progressive emaciation, ascites, hectic, dyspnœa, singultus, vomiting, and diarrhœa usher in the fatal termination. Blood mixed with matter ejected from the stomach, or with the alvine evacuations, not infrequently occurs, giving temporary relief, and the sanguineous discharge would seem for a time to ward off the mortal event. Such are the main symptoms of chronic splenitis, and more especially as the affection prevails in malarious countries.

Diagnosis.—When the patient complains of a dull, aching, dragging weight at the base of or below the left posterior thorax, with pains extending through into the back or radiating up into the left shoulder; when he lies on the left side or with some tendency to reclination on the back; when there is the clinical history of a residence in some aguish district; when the features look dusky, yellowish, and anæmic; when the lips and gums are bloodless, or when these symptoms have come on gradually, chronic splenitis may be suspected. Physical examination will pretty certainly confirm the suspicion. When the disease obtains, palpation and percussion discover enlargement of the viscus. The normal lines of dulness are in varying degrees exceeded, and the free border of the gland may be felt at or even below the costal edge; nor should it be forgotten, what has in this article already been insisted upon, that the viscus in health cannot be touched with the fingers. The patient in chronic splenitis bears examination much better than he can bear manipulation in the acute form. He generally can alter his position in bed, move the trunk, and make full inspiration and expiration without any great increase of pain. He does not complain of those stabbing and lancinating pains which are so symptomatic when the serous and fibrous envelopes are inflamed. Dulness, heaviness in the side, and aching, are the terms the patient uses as descriptive of his ailments. When dyspnœa and pleurodynia are present, it is presumptive that the upper part of the organ is more particularly enlarged and the seat of disease, and that pressure on the diaphragm has affected that organ. Chronic splenitis, with enlargement, which occurs as the rule, may be known from pleuritic effusion by negative as well as positive facts. There is not the intercostal stretching and bulging, nor that smooth rotund configuration of the chest-wall, which denote the accumulation of fluid. Percussion in effusion elicits an absolutely dull, dead sound, which to the practised ear is markedly

different from the kind of dulness produced by any other physical and pathologic changes. Higher up there may be friction sounds or ægophony. Again, in pleuritic affections there is the characteristic cough in the earlier stage of the complaint, and when there is the accumulation of liquid the dyspnœa is a notable condition. In pneumonia the dulness is not so absolute, it extends over a larger area, the breathing is quick and short, the countenance often has a venoid hue: the aspect, pulse, and temperature point to the pneumonic nature of the ailment. In inflammation of the peritoneum the decubitus, pulse, abdominal distension, the more extended tenderness, the drawing up of the legs, and thoracic breathing are significant of peritonitis. The peritoneum may become locally inflamed in splenitis, but in such cases the tenderness on pressure is circumscribed, there is not much abdominal distension, and the patient can turn towards the side, and he does not lie with his legs drawn up. The pain on pressure is confined to the left side. In nephritis the ordinary urinary tests and microscopical examination are our guide. In encysted kidney accurate manipulation will enable us to discover the one affection from the other. Ovarian tumor can hardly be mistaken for the complaint. Ovarian enlargement is first felt lower down in the abdomen, and there is generally resonance between the costal edge and the ovarian dulness. When there is a purulent collection in the splenic substance, the formation of matter is decided upon by the tenderness on examination; there are rigors, hectic towards evening, and in the course of time fluctuation may possibly be detected. Impacted colon may be judged of by its irregular contour, the sulci which can generally be felt, and a large enema either removes the tumor or alters its configuration. Malignant growths of the omentum are harder, flatter, broader, and their edges are less defined, and the clinical history will conduct to the correct conclusion.

Treatment.—When there is great and manifest enlargement, when the pain and aching are considerable, when it is believed there is some peritoneal tenderness, and when the affection occurs in a person of strong and unbroken constitution, leeches may be applied, and these should be followed by a large linseed poultice. When local blood-letting is not had recourse to, and as it seldom will be required, fomentations with strong poppy-head decoctions are soothing and beneficial. A large bran or linseed-meal poultice applied in a flannel or muslin bag is excellent practice. The poultice should be covered with cotton-wool, and over the latter should be spread a piece of oiled-silk sufficiently large to extend beyond the margins. These poultices should be frequently repeated, and never allowed to remain on when they are becoming cool. When the symptomatic fever is subdued, stimulating liniments, such as the soap, turpentine, and camphor liniments of the Pharmacopœia, or these may be combined, and the opium and belladonna liniments may be added. Terebinthinate epithems, and sinapisms are often of much service. Some authors recommend drastic purging, to be for some time continued. In the chronic inflammatory state there is no doubt that purging is one of the most successful and best remedies. Hippocrates and Celsus had observed the curative tendency of dysenteric complaints in splenic disease, and this salutary effect of increased action of the bowels can be well understood when considered anatomically and physiologically. Engorgement of the splenic veins produces vascularity in the vessels of the descending colon and rectum, because it engorges the inferior mesenteric, from which those parts of the alimentary canal derive their blood, and the hyperæmic mucous membrane constitutes the proximate cause of the dysenteric symptoms. Aloes, antimonials, and neutral salts, by determining the blood to the pelvic and abdominal vessels, produce the best results, and whenever the organ is relieved by nature or by art it is mostly by the vessels of the lower viscera receiving more than their normal quantity of blood. Certain Indian writers are of opinion that in enlargement of the Spleen a prompt antiphlogistic treatment should at once be employed. And they give it as the opinion founded on extensive practice that local blood-letting, epispastics, or counter-irritants, ought to be applied, and that brisk purgatives should be combined with such treatment. If antimony and salines be too long used, debility ensues. Recourse may then be had to the compound pill or the extract of colocynth, the compound jalap powder, and the various preparations of scammony, senna, and rhubarb. To act on the radicles of the portal vein is to relieve splenic as it relieves hepatic congestion. The combination of calomel may be advisable when there is a turgid condition of the liver. The employment of mercury, otherwise than in union with purgatives, cannot be too strongly reprobated, as all authorities are averse from its use except in the manner described. Lamentable effects have resulted from the way in which mercurials were formerly administered in splenic complaints; and from what has been said in this article relative to that dyscrasia of the fluids so commonly the accompaniment of the disease

of this organ, it is obvious that mercury is not only an unsuitable but a very deleterious agent. Some Indian writers have drawn terrible pictures of its ravages, and are most emphatic in its denunciation. A cloth dipped in dilute nitro-hydrochloric acid, placed over the splenic region, and then covered with an emollient cataplasm, is a means for adoption. The nitro-hydrochloric bath in the advanced and improving stage of the disease will expedite recovery.

The sulphate and tincture of the perchloride of iron in union with purgatives, more particularly the aloetic preparations, have been, and deservedly, lauded. When there is chronic splenitis with enlargement, amenorrhœa and chlorosis, iron in some form should be given. Twining speaks of what is termed the splenic mixture as prescribed in India, which consists of jalap, rhubarb, calumba, ginger, cream of tartar, and sulphate of iron. The nitric and hydrochloric acids with infusion of chiretta constitute a good medicine. A sea-voyage and change of air will often expedite the cure. M. de Parville has recently propounded the idea that chalk may be regarded as prophylactic, if not as a more absolute remedial agent, in splenic complaints. It was observed that during the prevalence of a splenic disease which affected sheep and cattle, that those animals which licked white-washed walls had in a great measure an immunity from the complaint. This effect of the carbonate of lime requires, however, in the human subject more evidence than has hitherto been adduced.

Diseases of Spleen in Children.

Lesions of this organ in children are by far most commonly seen in those who have lived in low and damp situations, or who have been brought up in malarious districts and tropical climates; we sometimes, however, meet with splenic diseases in children in this country, and more especially in dispensary and hospital practice, where poor and insufficient food, bad ventilation and humid houses have exerted a predisposing effect. Infants of a few months old sometimes have enlargement of this viscus, but in such instances the enlargement can hardly be referred to those more general and extrinsic conditions which so prominently enter into the etiology of splenic affections in the adult.

Causes.—The causes of the morbid changes in this gland in children and the young are as the rule malarial emanations. In aguish parts of the country, the kind of complaints now more particularly considered are not unfrequently seen. Protracted lactation may predispose to splenic ailments, but they are by far most usually met with as the accompaniments and sequels to intermittent and remittent types of fever. In certain affections of the liver which prevail amongst children the Spleen is apt to take on a congestive form of disease. The portal circulation being obstructed, fluxionary hyperæmia of this viscus may occur, and hyperplasia of the cellular elements at length take place. Quite independent of the malarial influence, the disease now known as leucocythæmia may come on in infancy and childhood, the causes of which are to be regarded as constitutional and not owing to unfavorable hygienic circumstances. In some instances, in children, the cause of its pathologic changes is degeneration of the walls of the vessels and the cell elements of the pulp, which go to form the lardaceous change, like to the lardaceous change in the liver. It may be in association with tuberculosis. In rachitis and scrofulosis a similar diseased mutation occurs. In hereditary syphilis this organ may present that amyloid degeneration which is now known to be so characteristic of this specific disease.

Symptoms.—When the affection is marked, the little patient lies on or towards the left side. Percussion discovers an increased area of dulness, and palpation detects the depending organ on or below the costal edge. The initiatory symptoms are restlessness, peevishness, anorexia, sleeplessness, and a disregard for wonted amusements. There is a loss of flesh and strength, the child becomes pale and sallow, the lips and tongue look bloodless, and the conjunctivæ are blanched. The skin is harsh, hot and dry, the pulse often quick and feeble, and there are giddiness, headache, and palpitation. Pain is readily produced on pressure below the false ribs, the knees are often drawn up, and the trunk, as the little patient lies on his left side or towards the bed, is curved. The bowels are generally costive, and the urine is pale, and there is an obvious increase of the pyrexial symptoms towards evening. Hectic, dyspnœa, ascites, diarrhœa, and sometimes œdema of the legs, and a greater or less degree of anasarca, supervene towards the end. In rickets, scrofulosis, and in leucocythæmia the organ is large and depending, and it becomes the largest in the last-named complaint. In these affections the patient's aspect is anæmic, yellow and waxen, but the symptomatic fever is much less, or may not obtain, nor are there the evening febrile exacerbations. Not unfrequently the liver is also large, so that the lines of dulness on both sides are much extended. When the he-

patic affection is marked, the superficial veins of the abdomen are apt to become full and turgid. With these forms of splenic disease there are petechial stains on the surface, and grave or even fatal epistaxis or hæmatemesis may come on. In syphilitic cases, from hereditary taint, when there is splenic enlargement, other and coexistent symptoms are observable. Coryza, cutaneous eruptions, and ulceration about the angles of the mouth are not uncommon. A yellowish ichorous discharge comes from the infant's nostrils, the lips are fissured, the Meibomian glands secrete pus, and often red, coppery spots can be seen on the skin. In such instances gummatous deposits are apt to be formed in other of the solid viscera, as well as in the Spleen.

Diagnosis.—The rules to be observed in diagnosticating splenic affections in children are much the same as those to be noticed in judging of the maladies incident to this organ in the adult. The clinical history aids in our decision, and the fact of residence where ague has prevailed at once points to the probable nature of the complaint. The physical signs in the child are easier of interpretation, more distinct and definite than they are in those who are older. The abdominal and thoracic walls are thinner and more resilient, and the internal parts can with less difficulty be felt. By careful examination of the chest, diseases proper to that cavity can with much certainty be excluded. Palpation, as above remarked, finds the edge of the gland and accurate percussion defines the extent of its increase. Jenner says, "If the fingers of the right hand are placed under the child's twelfth rib on the left side, and the fingers of the left hand a little to the left of the middle line, between the navel and the ensiform cartilage, and a pressure be made backwards and forwards, the Spleen may be readily felt." The front edge is more defined than the front part of a large kidney, and the dulness in a kidney extends fully up to and under the spinal muscles. The tumor of psoas abscess does not reach so high up either as the Spleen or a large kidney; it is circular, and the tenderness on digital examination is very great, and as the disease progresses the secretion gravitates downwards. The enlargement of this viscus is very generally the accompaniment or sequel of intermittent or remittent fever, and the symptoms of those diseases will without difficulty be recognized. In abscess there is more localized tenderness over the splenic region, there are rigors, and towards evening the little patient becomes flushed, hotter, and more restless. In leucocythæmia the organ may become so large as to apparently occupy half the abdominal cavity; there is then a markedly anæmic condition, and the abdominal veins are sometimes distended and tortuous. Syphilitic enlargement will be decided upon from what has already been stated when describing the various symptoms of the diseases of this viscus.

Treatment.— The treatment of splenic diseases in children should be on those more general and recognized principles which are to be observed in the adult, and which have already been given in this article; and also, it need hardly be remarked, that much exactness is always needed in prescribing for infants and young children, nor is it always safe to depend upon the doses which are arbitrarily fixed in posological tables; for it must be borne in mind that susceptibility in the young, with regard to remedies, is not unfrequently very pronounced. The duration of the ailment, and the general strength of the little patient will greatly determine the kind and amount of agent to be employed. If the child should evidently labor under acute pain; if the pulse be quick, the respiration accelerated, the temperature high, the skin hot and dry; if additional distress be caused on the movement of the trunk, or the inclination of the body towards the right side, and if a long breath cannot be drawn, and the urine be scanty, the bowels confined, the tongue coated, and there is much thirst, there will doubtless be more or less of acute inflammation. Not only may the fibrous and serous covering of the gland be inflamed, but the inflammatory action may have extended to the diaphragm, or there may be more or less of peritonitis. Fomentations and poultices should then be very sedulously applied, and if the acuter symptoms do not yield to their employment, leeches may carefully be used. Purgatives of senna, rhubarb, or some of their respective preparations, or some of the neutral salts, should be given. The hyperæmic distension by undue stretching excites the inflammatory phenomena, and to lessen the surcharge of blood in the gland is our aim; hence by acting on the bowels and thus unloading the venous radicles of the portal vein the splenic turgor becomes in an indirect manner lessened. A febrifuge may be given composed of the solution of carbonate of potash saturated with citric acid and flavored with the syrup of mulberries; or the nitrate of potash dissolved in water, made palatable with the syrup of oranges or the syrup of lemons, form another mixture which children will readily take. The acetate liquor of ammonia with some agreeable addition is a good medicine. When the symptomatic fever has declined quinine is then imperiously demanded. In the chronic, subacute, and

more congestive forms of the affection, purgatives with senna, rhubarb or scammony, some preparation of aloes, in conjunction with iron and sulphuric acid, should be prescribed. The nitric acid bath, or nitric acid applied locally (always taking care that this drug should, when thus rendered available, be sufficiently diluted) are not unfrequently of much service. When the complaint has evidently resulted from periodic fever, removal to another district or another climate is a desideratum. In the leucocythæmic form iron is the remedy upon which the most reliance can be placed. In splenic enlargement of infants caused by hereditary syphilis, small and continuous doses of the ordinary pharmacopœial preparation of mercury and chalk, and afterwards the iodide of potassium, constitute the best and most effective treatment. In all the varied forms of splenic diseases in children much attention should be paid to the diet. Articles of food should be selected which are light and nourishing, such as are blood-making and digestible. In winter and cold weather flannel underclothing is of great importance.

Abscess of Spleen.

Abscess of this organ is an affection which not unfrequently ends fatally. It is sometimes very insidious, taking place without any other symptoms than those of bad health and wasting. Upon inquiry it is generally ascertained that the patient has been subjected to the endemic influence of periodic fever, and that there has been pyrexia. It may be the result of acute splenitis, but it is more frequently caused by the subacute and chronic forms of inflammation. When the pus is in the centre of the gland, its diagnosis is most difficult, and it is only when it painfully presses upon the membranes that it can be detected. Shiverings, hectic, evening exacerbations, the general irritation caused by purulent absorption, and restricted secretions suggest its presence. Abercrombie gives an apt illustration of its covert progress in the case of a gentleman who for six months pined and wasted away without the exhibition of any local symptoms, save an insignificant catarrhal affection, and it was found on inspection that this organ contained a large abscess. Craigie bears like testimony, and observes that the most perplexing part of the semeiography and symptomatology is, that these collections give no evidence of their presence until by their size they painfully stretch the viscus and press upon surrounding organs. Heusinger and Schmidt say the same. Twining and Voight assert that splenitis rarely runs on to suppuration in India. When pus is formed in the organ, it is always as a rule the consequence of inflammation. Pus may be collected, however, in this viscus as it may be collected in the liver, in consequence of injuries in remote parts and when pyæmia is present in the system. Nor does the suppurative process exert that deleterious and destructive effect upon the structure of the organ which might be supposed. The filamentous tissue may be bathed in pus for a long time without injury. The suppurative formation in one or more sacs may be borne for a considerable period, and the parietes of such sacs at length become fibrous, cartilaginous, or even osseous, and the contents may, by partial absorption, be rendered a greasy, calcareous pulp. Much more frequently the inflammation by peripheral pressure of the sac extends towards the surface when the investments give plainer indications of lesion. There may then be adhesion to the diaphragm or abdominal wall, or to the stomach, colon, or ileum. Fluctuation may be felt and external pointing observed, just as these conditions are apt to be presented when there is abscess in the liver. The matter may be discharged in various ways. It may be poured into the abdominal cavity, when flagrant and fatal peritonitis rapidly follows. It may by cohesive inflammation and ulceration be evacuated into the stomach, when sickness and vomiting are produced. In like manner it may pass into the colon, or into the pelvis of the kidney, and be voided by the rectum or the bladder. Or the ulcerative process consequent upon pressure may be produced in another direction, and it may go through the diaphragm into the thoracic cavity, giving rise to pleuritis ; and in this way in some rare instances the pus has been transferred into the bronchi and coughed up, when it has closely simulated empyema. Mantell not long ago recorded a case in which the matter burrowed into the left lung and was expectorated ; and on examination of the organ after death it was discovered to be an empty sac, only containing a very small quantity of dark brick-colored fluid, which sampled with that expectorated. When the pus is carried into the kidney the symptoms of uræmic poisoning are rendered in greater or less degree apparent. When the secretion seeks an external exit the pointing may be anywhere between the ileum and the costal margin, or it may be between the umbilicus and the lumbar muscles. I have known the matter burrow through the abdominal wall and perfect recovery succeed. Grotanelli and Raikem record instances of spontaneous outcome of the matter through the abdominal parietes.

Reference has already been made to embolic infarction, caused by cardiac dis-

ease, and the localized inflammation which such event is liable to institute in the gland. The abscesses which follow are usually not large at the commencement, but they are apt to coalesce, and thus from this cause we sometimes meet with a considerable collection of pus; they give rise to perisplenitis, seldom to general peritonitis, and the capsule covering the subjacent deposition becomes thickened and its peritoneal investment is rendered vascular and opaque. At an earlier period of the formation of these spots a dark and congestive zone surrounds the embolized part, and the process of softening is first discovered in the centre of these cuneiform deposits. When of pyæmic origin or resulting from the secreting surfaces of surgical operations or suppurative wounds, the tendency to soften and assume the conditions of abscess is more marked than when the infarction is from pieces of lymph being carried in the circulation from heart disease. Sometimes hydatids produce abscess in this organ.

Symptomatology and Diagnosis.—It has already been stated that the symptoms of suppuration in this organ are uncertain and imperfectly pronounced; just as we know such uncertainty to obtain in hepatic abscess. There may be little or no pain, as is generally the case when the pus is formed centrally, and without the involution of fibrous and serous investments. There may not be either nausea or vomiting, if no irritation be given to the branches of the vagus. Before fluctuation can be absolutely felt there is always room for doubt as to the presence of the suppurative process. When fluid in the viscus is diagnosed, rigors and flushes and copious perspiration are the common objective symptoms. There is not unfrequently a hard dry cough caused by diaphragmatic pressure, and the pulse is usually full, quick and compressible. If, however, the peritoneal coat become inflamed, the pulse, instead of being large, acquires the characteristics of the pulse of peritonitis, by being of less volume and firmer under the finger. Pain in the left shoulder is not uncommon, and this fact was long ago pointed out by Grotanelli. More than half a century since he asserted that in splenic abscess there is pain in the left scapula and left shoulder. There is often aching behind the acromion process, and this dull pain may extend to the chest and up behind the neck. The pain in the side may remain for a considerable period stationary; it may increase or it may decline. If the matter do not quickly accumulate, the amount of pain remains the same. When it becomes augmented, this symptom may go on to be excessive. When there is absorption the pain gradually declines. When the matter makes its escape into one of the hollow viscera or externally, the mitigation of the pain is marked and sudden, and it may be at once abolished. The secretion may pass into the cavity of the peritoneum and alarming symptoms are marked and immediate. A great shock is given to the system by this grave and very commonly fatal event, the phenomena of which are readily interpreted. The pulse becomes quick and feeble, the features look pale and sunken, the surface is often bathed in a cold, dewy perspiration, there is a tendency in the extremities to become cool, the decubitus is on the back, with the knees drawn up, and the respiration is thoracic. After the supervention of these alarming conditions the mind is often clear, and it may remain unclouded to the last. With these grave changes the splanchnic nerves become potently impressed, the deep cardiac plexus and the branches given off to that plexus by the pneumogastric become paralyzed, and death eventuates from gradual arrestment of the heart's action. Collections of pus sometimes form in the abdominal walls, and such might take place over the splenic region; but in such instances the tumefaction is more superficial, and careful manipulation discovers it to be located in the parietes. In the course of time there is a brawny feel to the integuments beyond the limits of purulent deposit; they feel hard and tight, and the lines of dulness are ill defined. Again certain negative facts come to our help in forming a judgment on the point. In parietal abscess appearing in the place now named, it must be held in mind that the characteristic conditions of splenic disease would be wanting. The clinical history would tell of no endemic cause; there would be no account of intermittent or remittent fever; the peculiar cachexia of miasmatic poisoning would not be apparent, palpation would not discover the dependent edge of the organ, and the patient would be able to lie on the right side. Empyema might burrow and point over the situation of the Spleen, it might seek an exit as I have known it between the crest of the ileum and the costal edge, but the common cardinal and physical signs of pleuritic effusion would be our guide. The tumor of psoas abscess is not so high up as splenic tumor caused by suppuration, and pressure over the psoas muscle is likely to produce bulging of the fluid in the groin. Renal abscess and encysted kidney give indications by testing the urine. Leucocythæmic enlargement of the Spleen importantly differs from splenic abscess. The hardness of the first-named affection, the falling downwards into the pelvic cavity, the absence of rigors, flushes, and perspirations, would indicate the true nature of the malady. Malignant growths

in this situation would be readily excluded by the calling to mind many negative as well as positive facts whereon we base our conclusions relative to the presence or absence of carcinomatous growths.

Prognosis.—All authors and the best authorities are agreed that abscess of the Spleen, whether coming on from malarious causes or of pyæmic origin, is always fraught with great danger. In many so-called recoveries it was, perhaps, by no means absolutely certain that a suppuration had existed. In some few cases it is possible that absorption may take place, and the patient get well, just as this event, in exceptional instances, may follow purulent formations in the liver. There are various cases of a favorable termination recorded when the matter has by ulcerative absorption found its way into one of the hollow viscera, or when it has burrowed through the diaphragm into the bronchi; but the more frequent result is the catastrophe of the fluid's extravasation into the cavity of the peritoneum. It may, as before remarked, find an outlet through the parietes, but this mode of its escape is very rare, and even when it occurs, death generally ensues from protracted secretion, and the irritating and debilitating effects of a large suppurating cavity. When from pyæmia, it may be said that abscess of the Spleen is almost always fatal.

Treatment.—The treatment required in this affection is very much the same as the treatment required when the same kind of pathologic change takes place in the hepatic viscus. Both being solid organs, both contained in the abdominal cavity, and both being influenced by like impressions, it can be easily understood how they are subject to similar morbid processes. If the pain come on suddenly with accelerated pulse and exalted temperature, and the patient can with difficulty take long inspirations, such would infer inflammation of the fibrous and serous coverings. With these symptoms in a case occurring in this country, or in a patient who is a European and who has not been long resident in the tropics, and whose constitution has not been broken down by protracted exposure to the malarial influences, by intemperance, or other debilitating causes, leeches may be applied. Warm fomentations should also be used, and large poultices placed over the part. The latter may be made of bran or linseed-meal, or partly of linseed-meal and partly of bread. They should be placed into a muslin or flannel bag, covered with cotton-wool, and then a piece of oiled-silk should be spread over the edges. By this mode the heat and moisture are much longer retained, and thus the necessity for the local application being repeatedly changed is avoided, and consequently the patient is less inconvenienced. When there is symptomatic fever, saline purgatives, diaphoretics, and diuretics should be prescribed. The aperient may be the sulphates of soda or magnesia, Pullna water, the citrate of magnesia, or bitartrate of potash. A dose of the Carlsbad salts in half a tumblerful of soda-water sometimes answers very well. When the patient's strength is much reduced, the preparations of senna, rhubarb, or aloes may be given, and to any of these a small quantity of podophyllin may be added, whereby a bilious evacuation is promoted. In order to maintain an action on the skin, the acetate liquor of ammonia, in combination with the nitrous spirits of ether and camphor julep, may be prescribed. The nitrate of potash and the bitartrate of potash will keep up the function of the kidneys. When there is gastric derangement with flatulent eructations, the alkaline mineral waters are to be commended, particularly those of Vals, Vichy, and Ems. With the decline of the symptomatic fever quinine should be given in full doses, and most especially when the primary disease is of endemic origin. It ought also to be conjoined with sulphuric acid. When there is much pain, harassing cough, as there may be by implication of the diaphragmatic surfaces, some of the preparations of opium may be needed. It is always desirable that the patient's strength should be husbanded by continuous and refreshing sleep. Upon opiates the most dependence can be placed. In some instances the bromide of potassium, or ammonium, or the chloral hydrate, may be sufficient to calm the nervous system and give a good night's rest. It may be repeated here, what has already before been insisted upon, that mercury in any form should be avoided, either as an internal remedy or as an outward application. When the abscess points externally it is generally better to allow nature to effect an opening than to have recourse to the knife. There is then no injury done to the walls, and no shock given to the system. And where the matter is being spontaneously evacuated there should be no squeezing or pressure, and large and soothing cataplasms should be kept constantly applied. Under this plan of treatment the matter will escape in a slower way, but it is a more desirable mode of its evacuation. Harm is generally done by instrumental interference. When an artificial opening is made, air enters the sac and fresh inflammation is liable to be excited. A puncture can hardly be made without hemorrhage into the splenic substance. It must, however, be conceded that a hard and fast rule on the point in

question is not to be contended for, because in certain instances there might be the danger of expectancy. The continuous and unremitting augmentation of the fluid would jeopardize more and more the giving way of the sac, and if the rupture were into the abdominal cavity, that event, as it has repeatedly been observed, means death. If there were a projecting fluctuating tumor, with a pointing inflammatory blush, and it appeared that the integuments were resistive, a small trocar might be introduced, or Bowditch's aspirator might be employed. The canula of the trocar might, if its presence produced no irritation, be for a few days left in, or a pledget of oiled lint be placed in the orifice, and the instrument after an interval introduced. A large and moist poultice should after the operation be applied, and a full dose of morphia or Battley's liquor opii sedativus be immediately given. With regard to food, such articles of diet should be selected as are nourishing and easily digested. Strong beef-tea, which might be thickened with corn-flour, sago, tapioca, or rice; veal and ham broth make an agreeable change; and game and chicken panada are likely to be relished by the patient. Good milk, if the patient can take it, is always desirable, and it often agrees better with lime-water. It can be given in soda-water, and occasionally in champagne it suits very well. Light sherry, claret, burgundy, or marsala are perhaps the best stimulants.

Congestion and Hypertrophy of Spleen.

That congestion of this viscus may continue for a protracted period without giving rise to inflammation is unquestionable, and, as before observed, its distensile qualities favor the one and not the other condition. It is referable to mechanical obstruction, to fluxionary hyperæmia, or to a dyscrasic state of the fluids, though it may be produced by impediment to the circulation of the vena porta or cardiac disease. As a rule, its hypertrophy is not owing to mechanical causes; not unfrequently in heart disease, or cirrhotic and nutmeg-liver, the organ is found smaller than normal. In acute endocarditis, which implies blood disease, splenic hypertrophy is often produced. Wilks and Moxon assert that in ten cases of ulcerative endocarditis its average weight was as much as twenty-five ounces, and these authorities say that in ischæmia, without poisoning of the circulating fluid, and where inflammatory deposits did not exist, the gland was generally rather under than over weight. Its far more common cause, however, is the malarial influence, and those blood changes which miasmatic emanations engender. Wilks and Moxon say its hypertrophy when considerable is due to disease of its texture or of the blood. Between the blood, when contaminated with miasmatic poison, and this viscus there is some special and peculiar relation. Mere pyrexial exaltation of temperature is not the cause of its enlargement. There must be in addition some absolute and sanguineous change. The accession of its hypertrophy may be sudden or slow; if the former, the pain is urgent, and if the latter, there may be no pain. Vascular engorgement is more or less rapid, according to the injury which the constitution has received from the climate and the antecedent attacks of periodic fever which the patient has at varying times undergone. In temperate climates this pathologic state is of a passive character, being by no means so broadly marked as in tropical regions, where intermittents and remittents prevail. The hyperæmia may be temporary, and only cognizable during the cold stages of an ague; but if the vascular turgor be continually repeated, the fibrous structures and the proper parenchyma become hypertrophied — there is hyperplasia. Whether the unusual accumulation of blood depends upon increased action of the arteries, or on inability of the veins to remove it, is a question not decided, but the results are the same, stasis being effected enlargement must follow. In aguish districts it is not uncommon for persons to have splenic enlargement for many years, and die from other diseases; and it has been stated that individuals have had hypertrophy of this organ through life. Haller and Lieutaud mention such cases.

Often it must needs be an arbitrary distinction between congestion and a low and an ill-defined inflammation, knowing as we do by what insensible gradations these respective conditions pass from one into the other. Baillie says there may be congestion with healthy structure. This, however, will depend much upon the degree of the hyperæmia. Craigie believes its increase of volume to be an incipient morbid state which will progressively terminate in another morbid state. Primarily, simple congestion may eventuate in inflammation, and congestion and hypertrophy stand in relation of cause and effect. An often-repeated afflux of blood not only mechanically distends the organ, but conveys an abnormal amount of those assimilative materials which produce excess of nutrition, and consequently abnormity of the tissues. The effects of such sanguineous afflux are in other ways apparent. Hyperæmia in an organ is succeeded by impairment of its functions, and the sum of such impairment stands

in just correlation to the amount of hyperæmia. If then the office of this gland be the elaboration of the formative materials of the blood, the evolution of an albuminous plasma from which the germs of the blood-corpuscles are derived, and, too, according to Kölliker, the dissolution of the old and effete corpuscles, the morbid enlargement of this organ must necessarily have a deleterious reaction upon the entire volume of the sanguineous fluid, and also upon the general powers of the constitution; hence it becomes explicable why congestion and hypertrophy are associated with pallor and sallowness, diminished vital action, and all the debased conditions of anæmia.

Symptoms and Diagnosis. — When the congestion comes on suddenly the subjective symptoms are more pronounced than by mere dulness, aching, and dragging in the side; there may be in addition absolute pain, which is accompanied by more or less of febrile phenomena. There is a complaint of fulness and uneasiness under the left costal edge, and moderate pressure confers the feeling of soreness and tenderness; there is often some cough and inability to lie on the right side. Aching of the shoulder is another fact not uncommonly mentioned, and not unfrequently the stools are very dark, evidently malænal, when the urine is pale. The digestive and assimilating functions become impaired, the epigastrium is rendered smooth and rounded, and often there are eructations and flatulency. Upon investigation it will generally be discovered that there is an unfavorable state of the constitution. The conditions more distinctive and observable of the malarial influence are in most cases discernible. In the more chronic examples the dull, dead, puffy, facial expression, the pale conjunctiva, blanched lips, gums, and tongue, unmistakably bespeak the anæmic change. Loss of flesh and strength are the common accompaniments, and the tendency to hemorrhage attests the morbid alteration of the blood, and the want of nutrition in the capillary walls, which such alteration has produced. The skin is often cool, the pulse slow and compressible, and the temperature not more than the normal standard. In cases of long standing in which the organ has become hypertrophous, it often happens that the lymphatic glands are large, more especially the submaxillary, inguinal, and axillary, which is a coexistent pathologic change that can readily be understood from what has already been said in a foregoing part of this article. Niemeyer thus accounts for this symptom of lymphatic enlargement: "When the cells formed in the intertrabecular spaces of the Spleen, or in the cells of the lymphatic glands, are retained in any way, and are not normally borne along by the blood and lymph, they accumulate in these places; the Spleen or the lymphatic glands, as the case may be, swells up and the blood becomes poor, as the used-up blood-corpuscles are not replaced by others. If the obstruction to the passage of the young cells into the circulation be removed, the growth of the Spleen and the lymphatic glands ceases, and the blood is gradually improved by a sufficient supply of young cells, even if the enlarged Spleen or lymphatic glands do not increase in size." The facts to be observed in diagnosis are very similar to those enumerated under the head of Chronic Splenitis; ordinarily, congestion, as before insisted upon, is very generally the prelude to those more absolute morbid changes which constitute the inflammatory process, and it thus may be a mere arbitrary distinction which defines where the one state terminates and where the other state begins. In such instances the absence of febrile phenomena would be a weighty negative fact, influencing our decision. When the organ acquires increase of size, as the concomitant or sequel of one of the types of continued fever, the state may be regarded as that of mere congestion. The hypertrophous enlargement comes on more insidiously, the hardness is more proclaimed, nor is there so much tenderness to the touch, and investigation will mostly discover the malarial cause, and if such be not the case it will generally be found that there has been a foregoing hepatic disease which has produced organic obstruction to the portal circulation. The general appearance and the constitutional circumstances should always be carefully reviewed in the endeavor to arrive at diagnostic correctness.

Treatment. — When the history of the case points to malarial causes, the speedy removal of the patient from endemic influences becomes of course the first recommendation. Quinine and the various preparations of Peruvian bark are also to be sedulously taken. MM. Caron d'Annecy, Balby, and Piorry place the most reliance on cinchona. The removal to a more healthy climate would doubtless often suffice, but the cure would be unquestionably aided by the specific medicine. In the more active examples of congestion, when there is sharp pain, shallowness of breathing, and considerable distress, those means may very properly be had recourse to which have above been given when describing the treatment in chronic splenitis. The secretions and excretions should receive our attention, and the depurating organs be maintained in active function. Cholagogue aperients by

freeing the hepatic system have a good indirect effect on the gland. The venous radicles of the portal vein should, by salines, the decoction of aloes, by senna, rhubarb, or scammony, be acted upon. Tonics such as gentian, quassia, calumba, with occasional aloetic and myrrh pills, are effective, and the sulphate of iron, or the tincture of the perchloride of iron, should in some combinations be taken at the same time. Ferruginous medicines with sulphuric acid constitute a most effective means of treatment. The natives of India have from time immemorial employed a nostrum composed of garlic, aloes, and vinegar, and as a topical application the actual cautery. Shulbred's powder, consisting of jalap, rhubarb, calumba, scammony, the bitartrate of potash, and sulphate of iron, has for half a century been a favorite remedy in Bengal. Twining's formula is a compound of jalap, rhubarb, calumba, ginger, bitartrate of potash, sulphate of iron, senna, and mint water. In India the kala-nimuk, or black salt, of the bazaars is another remedy of ancient use. It consists of the muriate of soda, sulphur, muriate of lime, and the black oxide of iron. The decoction of the seed of the carum nigrum with acetic acid or lemon-juice is also an Indian medicine. Martin thinks highly of the saccharated carbonate of iron, the tincture of iron, and the tincture of iodine, and also the iodide of lead administered externally. This physician in addition recommends the iodide of potassium, warm baths, stimulating frictions to the splenic region, and gestation in the open air. Like most of the writers on this disease, who can speak from experience in intertropical countries, he warns against blisters, as they are apt to slough, and lays emphasis on the fact that mercurials are most injurious and destructive. At the Netley Hospital a combination of the phosphates of quinine, iron, and strychnine has been successfully used. The nitro-muriatic acid with bitter infusions is often of decided service. The diluted nitric acid, applied locally, and the nitric acid bath, have by some been regarded as very effective. The tincture of iodine diluted in the proportion of one part of the tincture and six or seven parts of water, painted over a large area of the splenic region and abdominal surface, is sometimes very beneficial. The natural chalybeate waters are often followed by a diminution of the gland. Grotanelli speaks of the practice of percussion over the splenic region as an old method of cure, formerly had recourse to in Southern Italy. In the more chronic or hypertrophous enlargement the same kind of remedial measures may be pursued. Dry friction in such examples is serviceable. The hepatic secretions should be looked to with much care in these cases. Henry, Andral, and Piorry insist on the good effects of the cold douche. In hot weather cold sponging and sea-bathing assist other means adopted. The diet should receive particular attention. If there should be any symptomatic fever, and high temperature in the earlier of the congestive stages, the food should be mainly farinaceous, and if milk agree with the patient it may be given. Soups, broths, and jellies and light puddings may be allowed, and even where there is no febrile disturbance too liberal a supply of animal food ought not to be permitted. The aërated waters are relished and to be advised as drinks, such as soda, seltzer, potash, and lithia, and the Apollinaris waters. Dry sherry, Marsala, claret, and Burgundy are perhaps the most desirable wines which the patient can take when stimulants are indicated. Places of residence of greater altitude and drier atmosphere are often followed by marked advantage.

[Mosler[1] has proposed the injection of tincture of iodine as a local treatment for enlargement of the Spleen. Hypodermically used, it may be safe; if introduced so far as the Spleen itself, the danger of peritonitis must be considerable. Several practitioners have employed hypodermic injections of ergotine[2] for the same purpose, with asserted success.—H.]

Splenalgia.

Splenalgia is a non-inflammatory and suddenly painful affection of the viscus which the older authors termed dolor lateris and splenis dolor. Voight describes in careful detail what he names splenalgia congestionis, but the affection to which he refers is evidently one of those more protracted forms which are occasionally met with of chronic splenitis. Sudden and powerful muscular exertion, by rapidly determining the blood to the internal parts, and there disturbing the equilibrium of the circulation, will give rise to it. The organ, as it has before been observed, being a diverticulum to counterbalance the inconvenience which would otherwise ensue from inequalities in the visceral circulation, its quick distension with the vital fluid renders the tunics tense and consequently painful. In certain hysterical and uterine affections, more especially in attenuated and anæmic females, the gland is sometimes sympathetically affected, the cause being a morbid sensibility of the nerves proper to the part, just as we know under like circumstances these anomalous pains in

[1 Ziemssen's Cyclopædia of Practice of Medicine, vol. viii.]

[2 Am. Journal of Medical Sciences, Jan. 1875.]

nervous patients incident to other organs and localities of the system. During the cold stage of an ague, by a rapid afflux of blood, it will become acutely painful, and the pain immediately subside on the supervention of the hot stage. Its adhesion to the diaphragm is not unfrequent in those more especially who have resided in tropical climates and miasmatic districts, and who, during the progress of periodic fever, have had the organ distended and inflamed. This morbid attachment to the diaphragmatic surface has been considered, and not without show of reason, to be the cause of that sudden, and sometimes severe, pain experienced over the splenic region. Young people of both sexes, after violent exercise, will complain of stitch in the left side. Great runners induce this condition.

Symptoms and Diagnosis.—The affection may be recognized by its sudden accession and its rapid subsidence. The absence of the ordinary febrile phenomena will point to its neuralgic character. The patient takes long sighs; he places his hand involuntarily on his left side; he tries to make a deep inspiration and cannot; his trunk is slightly curved to the left; and there is a disposition to remain in one position. The pulse and temperature are normal, and the manner of its coming on makes no suggestion as to its being inflammatory. It cannot well be mistaken for pleurisy, because pleurisy is ushered in by a different train of symptoms. That disease supervenes more slowly, more progressively; the hard, dry cough, the pulse, heat of skin, and the physical signs distinguish the one from the other. In pleurodynia, which is an affection of the intercostal muscles, or the fibrous fasciæ lining the chest, and mostly a rheumatic affection, and though in the great majority of instances it is in the left side, it can with moderate care be discriminated from splenalgia. In pleurodynia sudden twisting and movement of the thorax aggravate the pain. Digital pressure on the intercostals increases the discomfort; it is more commonly seen in men than in women, and in those whose systems are lowered from some debilitative cause, or who live in damp houses and cold and wet situations.

Treatment.—Such agents as are usually employed in neuralgic affections are to be used in splenalgia. In those of nervous and excitable temperaments the restorative and tonic treatment is generally the most to be relied upon. Ferruginous and chalybeate remedies are chiefly indicated. The class of agents usually called nervine tonics, such as the various preparations of iron, zinc, valerian, and ammonia, are to be commended. The natural mineral waters which are ordered in the condition of lowered vitality and general debility are frequently beneficial. Stimulating liniments, friction, change of air, and flannel under-clothing, are to be suggested. In such cases as may come on from violent and undue exertion, rest and quiet are the obvious recommendations.

Tumors of Spleen.

The tumors of this organ can mostly be distinguished from other tumors by their obliquity from above downwards, by their lying from left to right. They are sometimes very large. Pemberton mentions a Spleen which weighed three pounds. Morgagni saw one of eight pounds and a half. Elliot describes one of eleven pounds. Bree declares this gland may be so augmented in size as to weigh from twenty to thirty pounds. Portal knew it weigh thirty. Lieutaud found it in a woman, who had been long ill, weigh thirty-two pounds. And Twining states that in extreme cases in Bengal this viscus has been discovered so large as to fill up half the cavity of the abdomen. There are two forms of configuration which it usually assumes on its tumefaction, and these are the rounded, or globular, and the oblong. The globular results from disorganization of the blood, and it is the accompaniment of an acute dyscrasia such as obtains in periodic, malignant, relapsing, and exanthematous fevers. Rokitansky believes this condition to be dependent upon stasis affecting the vascular system of the fundus ventriculi and the deposition of a dark pultaceous mass somewhat resembling the medullary matter found in the typhus mesenteric gland. The oblong is of firmer consistency, the edge being often notched and fissured, and the color is not so dark, it being of a yellowish or reddish-white appearance. It gives evidence of a more sthenic type of inflammation. There is adhesion of the tunics; fibrinous matter is deposited in the parenchyma, and this deposition, by encroaching on the vascular network, gives rise to pressure, whereby the coloring particles of the blood are absorbed, and hence the lighter hue. This is its configuration in leucocythæmia. Tumors having as their cause suppression of menstrual or hemorrhoidal discharge, assume the last-named appearance, which is the condition of a slow and gradual degeneration. In order to detect the presence of the organ when tumid, the reader is referred to what has already been said under the head of General Symptomatology.

General Morbid Anatomy.

It may be remarked that in observations made on the appearance of this organ as revealed by dissection there is not unfrequently no little difficulty in arriving at a correct conclusion, because the morbid conditions so gradually merge from one into another that it must needs be but an arbitrary distinction where the attempt is made to nicely define pathological changes. In the inspections made on many other dead parts it is not so, as the cadaveric alterations are more characteristic and cognizable than they are in this viscus. The color and configuration of the organ vary under the different morbid processes to which it is subject. It is discovered paler or darker than normal, or it may be of blackish-brown color. In malignant and putrid fevers its color sometimes approaches to black. It may be rendered rounder or more elongated than normal, and its fine border sometimes loses its sharper shape. And I have seen it much flattened and more spread out than natural. Andral considered that it would confer preciseness and facility in these investigations if our researches were brought to bear on two component parts; that which is contained, the blood, and those fibroid, serous, vascular, and other structures which go to make up the main substance of the gland. It may be said that the increase of size and variation of consistence are the most usual and striking changes which result from its disease. By long and continuous hyperæmia the capsular coverings become thick and dense, and the trabeculæ in corresponding manner are rendered larger and more numerous. When acute inflammation has obtained, and localized peritonitis has taken place, the serous covering is then found thick, opaque, and unyielding. Sometimes it is white and nodulated. Bristowe, on microscopically examining a specimen of fibroid degeneration of the capsule, found transverse sections of the fibrous tissue to exhibit interlacing hyaline bundles, which in the situations where calcareous deposit was found spreading, contained in their interstices a number of highly refractive granules, most of which disappeared with the evolution of a quantity of gas on the addition of dilute hydrochloric acid.[1] This observer also goes on to say that on section being made parallel to the surface of the organ, the interlacing fibroid bundles could not be recognized, though planes of almost structureless tissue were still to be seen more or less covered by refractive particles similar to those which were seen in the previous sections lying in the interstices between the fibres. The under surface of the diaphanous membrane is adherent to the fibrous tunic, and externally the organ becomes attached by holding masses and bands of lymph to contiguous viscera, to the abdominal parietes, and in some instances to the concave surface of the diaphragm. The serous coat may be noticed red and vascular. Sometimes there are in the adventitious products loculi filled with serum in addition to the serous exudation which is effused into the abdominal cavity. The inflammatory process, as the almost unexceptional rule, extends deeper than the capsular investments, and if careful examination be made, it very generally occurs that a greater or less amount of thickness of inflammatory exudation can be detected in the parenchymatous substance. Indeed, in all examples of acute peritonitis it can hardly be affirmed that the inflammation is absolutely confined to the serous membrane. Under the inflammatory condition the fibrous parts may take or contain heterologous transformations, they may become in greater or less degree cartilaginous or even osseous.

[1] Trans. Path. Soc. vol. xviii. pp. 257–8.

Softening of Spleen.

Softening is a pathologic change more frequently discovered in this viscus than any other morbid appearance, and it is much more common than induration. It is sometimes impossible to say whether the softening be from mere blood stasis or inflammation. In some instances of sudden death the organ has been found large and soft when there were no reasons to suppose the existence of any foregoing disease. Softening is the common condition which follows pernicious, periodic, malignant, and relapsing fevers. The specific poisons generative of febrile diseases, by contaminating the entire current of the blood, are followed by local as well as the more obvious general phenomena, and organs and tissues through an impaired nutrition exhibit in varying degrees the more manifest conditions of absolute lesion. Under the influence of these poisons this viscus is particularly prone to the loss of vital cohesion—in other words, to a breaking up of its ultimate structure—and is certainly much more prone to such disintegrative change than any of the other solid abdominal organs. This altered state of the blood gives rise to the want of normal molecular affinity; the pulp becomes, it may be, semi-diffluent, and the capsule holds not a consistent substance, but debased, broken-up, bloody contents, and the contained grumous fluid has been likened to the muddy lees of red wine, or even unto

tar. The gland sometimes resembles a dark resistless clot, invested by an attenuated and tender membrane, which, on the most careful handling, breaks, the contents flowing out as a black, inorganic, putrid gore. In the more malignant forms of remittent fever such appearances have been recorded. The first morbid transformation is deepening of color; it assumes a dark brown, or it may be black. The pulp degenerates into deliquescence, and the trabeculæ are reduced to shreddy fibres. A stream of water poured upon the loose substance readily washes away the pulp, and the trabeculæ remain, giving the appearance of stringy fibres. The various accounts given of the Walcheren fever record marked illustrations of this condition; and the organ was often seen to weigh four or five pounds, and looked like a membranous bag filled with tar. All authors who have carefully described the morbid appearances in typhus, enteric, and relapsing fevers have mentioned alteration of color and softening as the common characteristics of this organ. In typhus, in well-marked instances of splenic lesion, the parenchyma is rendered so soft and resistless that it readily breaks under the fingers, and it may be converted into a diffluent grumous fluid. It was soft in fifteen out of twenty-two cases examined by Peacock, and in thirteen out of thirty-one examined by Jenner. Murchison says that in this disease it is not unfrequently reduced to a reddish-brown pulp, which runs out when the capsule is divided. In enteric fever Louis found it soft in thirty-four out of forty-six cases; Jenner in four out of fourteen, and Murchison in ten out of twenty-one cases. Andral gives similar testimony. The blood in this type of fever is seen to contain an excess of white cells, sometimes amounting to three or four times more than are found in healthy blood. From extensive personal experience in relapsing fever, I can assert that there is no organ so frequently discovered to have undergone alteration in structure and consistence as this gland, and softening is also uniformly observed. In this type of fever it is rendered larger and softer than in typhus and in the enteric form. In a number of inspections which I many years ago made on the bodies of those who had died of relapsing fever I never saw the viscus healthy. It was sometimes remarkably large and soft, the capsule was not prone to become inflamed, inflammatory products were not found on its surface, but by pressure it was more readily ruptured, the parenchyma easily broke on pressure, the contents were sometimes diffluent, and the dark reddish, semi-fluid bloody matter had a jam-like appearance. In the exanthems, more especially in the malignant types of scarlet fever, and sometimes in measles, this gland is discovered soft and friable. Hemorrhagic infarctions which terminate in puruloid depositions are accompanied by loss of interstitial cohesion and general consistence. In pyæmia, when those central and pyramidal patches of congestion which go on to the suppurative condition take place, partial or more general softness is the common accompaniment. In anæmia and hydræmia, and what is termed the dropsical crasis, the organ may be rendered softer as well as paler than natural.

Induration of Spleen.

Induration of the gland is seen in very various degrees. It may be hard and condensed, or merely be somewhat increased in firmness. This change will depend upon an increase of vital cohesion in the normal structures, more especially in its fibrous and vascular elements. Continuous hyperæmia is succeeded by hyperplasia, more organizable properties may be formed in the cells, and in low forms of its inflammation lymphic deposits may eventuate in the loculi or amongst the filamentous tissues. In this abnormality of firmness the changes are in nearly all instances accompanied by enlargement and varied configurations. There is, too, much difference in the color externally, and when sections are made of its parenchyma. Sometimes, as Bright remarks, the substance on being cut looks like damson cheese; and in other instances, as in leucocythæmia, it is of a pale dirty yellow. Diemerbroeck describes a black induration. On the whole it may be asserted that lymphic deposit is the chief cause and characteristic of its more resistive condition. Sometimes it cuts with considerable hardness, and sometimes I have seen it so friable as to break like old cheese. In those exceptional examples in which the cartilaginous generation is manifest the entire fibrous structures of the organ are augmented in bulk and increased in density. The envelopes then assume this transformation. That condition when the organ is enormously enlarged, and which Bright called *fleshy hardness*, was evidently that hypertrophous condition now regarded as the invariable and distinguishing pathologic change in leucocythæmia. The older physicians erroneously looked upon induration as identical with scirrhus; and Sauvages records a so-called scirrhous spleen which weighed thirty pounds, but which had doubtless been the usual state of leucocythæmic enlargement.

Atrophy of Spleen.

Atrophy in marked degree is rarely witnessed, and it may be said that any diminution of its volume is much less common than its increase in size. Haller, Morgagni, and other of the older writers speak of this change, but in a manner so loose and inexact that little reliance can be placed on their statements. In some chronic diseases, where there has been renal wasting, or great periodic discharges of blood, it has been found small and shrivelled. Bree says it has been discovered so diminished as to be of the smallest size, the capsule only containing a little of its vascular substance; Thomson declares it may be reduced to the size of a walnut, or even less; and Andral records that he saw it not larger than a walnut. Dr. Church showed a small Spleen at the Pathological Society, taken from the body of a woman who died of pleurisy and ascites, which only weighed five drachms and fifteen grains. It may be discovered in a mere rudimentary state; and it has been asserted that the viscus is sometimes wanting.

Hemorrhage into and Rupture of Spleen.

Hemorrhage sometimes occurs. Blood may be extravasated into the parenchyma without solution of the tunics, which occurrence has been by some morbid anatomists named "apoplexy of the spleen," from the like extravasations which are discovered in the brain and in the lungs. And more accurate observers have noticed that occasionally the remains of apoplectic effusions are detected in the presence of circumscribed reddish-brown spots, which are permeated and surrounded by lymphic deposits. These have been regarded as the abiding evidence of antecedent vascular solutions. In very exceptional instances the coats may give way, and blood be effused into the abdominal cavity, when fatal peritonitis would, if the quantity were at all large, eventually follow. The toughness and strength of the fibrous covering provide against this event, and render the accident of its rupture exceedingly rare. In those cases which have been recorded of this catastrophe, there has generally been a foregoing or primary, and mostly a febrile, affection of pernicious or malignant type, which has contaminated the entire circulatory fluids, and in secondary manner injuriously acted upon the muscular and fibrous tissues. Acting as a diverticulum, as it does to the visceral circulation, and thus necessarily being liable to be surcharged with blood, nature has provided this organ with coverings which are stronger and more elastic than the coverings of the other solid viscera; and, I believe, unless the tunics have by foregoing lesion lost their normal resilience, and thus been rendered liable to solution of continuity, that their giving way never occurs, or that such event is infinitely rare. Sometimes the coats of the vessels spontaneously enlarge, and thus under pressure may give way. Traube and Cohnheim related an instance of sudden death from rupture of a series of dilated veins of the Spleen. These veins were so elongated and distended that they were six inches in length, five in breadth, and two in thickness. Rupture is most liable to supervene in the hyperæmia of pernicious fevers. In tropical countries when the viscus from endemic causes is liable to great distension, comparatively slight blows, falls, or compression are sufficient to produce its laceration. The giving way of its coats does not in any case necessarily imply a fatal termination, as instances have been recorded where a cicatrix has shown the former solution of its tunics, and when the patient has lived for a long time afterwards. Such examples have, however, resulted from accident, or were of traumatic origin, and when the splenic pulp did not become extruded from the bursting of the diseased and tender envelopes. Rupture has been known to take place during the hot stage of an ague, and in typhus and in cholera. Babington once examined the body of a patient in whom this viscus had been completely detached, and was found loose in the pelvis; and in that instance most violent sickness had preceded death, and the powerful efforts in vomiting were considered as being the cause. Two peculiar cases of spontaneous rupture are recorded by Rokitansky, and these were in the instances of two workmen, aged respectively forty-eight and nineteen years. Both had leucocythæmic tumefaction of the organ; in both examples several pounds of clotted and fluid blood were found in the abdominal cavity, and in both the gland was five or six times larger than normal. Sir James Simpson records three fatal cases of this kind of rupture, which occurred respectively during the pregnant, parturient, and puerperal states. In one case the viscus became large during pregnancy, and the enlargement always disappeared after delivery. A woman showed symptoms of fatal sinking shortly after labor at the sixth or seventh month, and autopsy showed a laceration of an enlarged Spleen, with effusion of blood into the peritoneal sac. In another patient the woman, after making some unusual exertion a week or two after delivery, complained of abdominal pain and a feeling of

s'nking, and then soon afterwards died, when splenic rupture and effusion of blood were revealed on inspection. The late Dr. Cumming delivered a woman by the forceps, who died in the course of a couple of hours afterwards, and examination showed a similar circumstance to have taken place. According to the accounts of the Russian epidemic of relapsing fever in 1864–5, as given by Fittermann and Küttner, in three instances out of seventy inspections the organ had spontaneously ruptured. Mr. Atkinson of Leeds has published[1] an apt example similar to the above. A lady, thirty-five years of age, was suddenly attacked with sickness and violent vomiting, which was soon accompanied by pain in the left side; these symptoms were succeeded by lividity, cold extremities, and all the phenomena of fatal collapse, and death took place at the end of twenty hours. On inspection it was discovered that there was a large collection of blood in the abdomen, which had evidently proceeded from a rent in the gastro-splenic omentum, and the Spleen was found shrunken, pale, and flabby. Dr. Deville of Harrogate has kindly sent the writer particulars relative to an instance of spontaneous splenic rupture which recently occurred in his practice. The patient was a man of thirty-six years of age, and of temperate habits. He had been laboring under an attack of continued fever, and was progressing towards recovery, and was so far convalescent that he was enabled to dress and sit in his chair. An acute pain suddenly came on in the left hypochondrium, and after this he rapidly passed into a state of collapse, and died. Inspection revealed a fissure parallel with and anterior to the hilum lienis, and some of the splenic pulp had been extruded into the peritoneal cavity. The Spleen was exceedingly friable and broke on removal. Blows, falls, and compression have caused its laceration. Professor Fayrer records the accident of rupture in an Hindoo woman aged thirty-five, who fell from a tamarind tree and broke both her arms, and who died of tetanus sixteen days after the fall. The examination exhibited two ruptures in the posterior edge of the organ, the upper edge being very deep. Charcot delivered a woman in whom the Spleen of the fœtus was found ruptured, and this accident it appeared had been preceded by two falls, one which the mother had sustained a month and another a fortnight before her confinement. Mr. Richard Davy narrates the instance of a woman who had been run over, who was admitted into the Westminster Hospital, and who died two hours after admission. The portion of Spleen corresponding to the suspensory ligament was completely crushed off from the remaining five-sixths of the organ, and there were three linear rents in the capsule. It has been remarked that the horse under powerful muscular efforts is liable to rupture the Spleen.

[Although treatment for rupture of the Spleen must be usually hopeless, it may be mentioned that hypodermic injection of ergotine has been resorted to for it.—H.]

[1] Brit. Med. Journal, Sept. 26, 1874.

Gangrene of Spleen.

Gangrene of this organ is exceedingly rare, and the accounts of its occurrence are so scanty that nothing reliable can be said of its symptoms. Murchison, however, says that in gangrene of this viscus after typhoid fever there is very rapid sinking. Baillie mentions having found it in a gangrenous condition. The older authors speak of gangrene of the Spleen, but their inaccurate and often erroneous descriptions of morbid changes throw much doubt upon such assertions, as upon many other of their statements. They were not conversant with many morbid appearances as modern pathologists are conversant with them. Recent observers of the most ample experience have not witnessed more than one or two illustrations of this most uncommon diseased condition. Rokitansky bears testimony to its rarity, and speaks of having only once seen it, when it affected the organ to a considerable extent. Ollivier, Portal, and Morgagni, and their contemporaries, doubtless regarded that black, grumous, broken-up state of the pulp which obtains in periodic, yellow, and malignant fevers as gangrene, which, however, differs greatly from gangrene. Hertz of Greifswald lately gave particulars of an instance of this morbid alteration in a young woman who had been admitted into the Greifswald Infirmary for abdominal disease consequent on the abrupt arrestment of the catamenia. The post-mortem examination gave evidence of pleuro-pneumonia with pleuritic effusion, and the diaphragm was partly gangrenous, and the Spleen almost entirely in that diseased condition.[1] Authenticated instances of splenic gangrene may be regarded, and truly, as among the curiosities of medical literature.

Hydatids of Spleen.

Hydatids have occasionally been discovered in this organ, but far less frequently than in the liver. They as rarely affect the Spleen as cancer, and when

[1] Virchow's Archiv, xl. p. 580.

seen are often in association with hydatids of the liver. They may be within the substance, between the tunics, or be attached externally. They are seldom found in the pulp, and mostly in the gastro-splenic epiploon, or in the cysts constituted of the serous investment. There are no rules for their diagnosis; they sometimes, however, produce a bulging out over the splenic region, in the form of smooth hemispherical protuberances. Duroziez narrates an instance of a splenic hydatid which was voided by the bronchi. A man admitted for hemiplegia spat up a substance resembling boiled white of egg, which proved to be the débris of an hydatid cyst. At the autopsy the Spleen was found to be hollowed out into a vast cavity which contained thick, dark-colored fluid and dark-brownish flocculi. Wilde gives a case of hydatid of this organ in a girl of eleven years of age, in whom the tumor reached three-fingers' breadth to the right of the linea alba, and from a point in the latter, half way between the umbilicus and the pubis, to another half way between the former and the ensiform cartilage. In *St. Bartholomew's Hospital Reports*, Vol. viii. p. 181, Dr. Wickham Legg gives the case of a man who died after having epileptiform attacks and delirium, and on inspection the Spleen was found small, adherent to the diaphragm, and in the upper part was a putty-like mass, within which was crumpled up, in a manner resembling the plicative æstivation of some flowers, a transparent membrane which showed a laminated structure, and thus evidently proved its hydatid character. Dr. Coley showed at the Pathological Society a hydatid cyst connected with this organ of the size of a cocoa-nut. When thus large they may be fatal by pressure being exercised on neighboring organs, or by being extended into the peritoneal sac, and thus giving rise to flagrant peritonitis. Some very rare instances are recorded in medical literature, in which the cyst, by adhesive inflammation, had become agglutinated in the abdominal walls, and the contents escaped externally and harmlessly. Andral speaks of *other cysts*, which he describes as small vesicles filled with serous fluid, floating in or attached to the splenic veins; and of a cyst with fibro-serous tunic filled with hairs. Wilks relates the case of a Spleen being found in the body of an old woman, whose kidneys had presented cysts. The organ was of the average size, but at its lower end was a cyst the size of a walnut, and on its surface were smaller ones, all of which contained serum and were lined with a smooth membrane. This physician is of opinion that there was in this instance evidence of distinct cystic disease, and he comments upon the rarity of the affection as occurring in this gland, there being only one other specimen of a similar kind in the museum at Guy's. The remains of hydatid cysts are sometimes associated with surrounding fibroid thickening and cartilaginous hardening, or there may be calcareous infiltration. Bastian discovered a shrivelled hydatid cyst, the walls of which were about a line in diameter, and the microscopic examination of this wall was found to consist of innumerable hyaline concentric layers, some of these being forty times as thick as others; on the surface of the inner layer were traces of granular germinal membrane, and in the centre were fat and proteine granules, with amorphous carbonate and phosphate of lime. Manchartus once beheld a cyst in this gland which contained four pints of fluid. Spillman has recorded a remarkable case of cystic hæmatina of this organ.[1] It was of the size of an infant's head, attached to the inside near the hilus. The interior of the cyst was made up of a number of communicating anfractuosities filled with a yellowish fluid containing cholesterine. The character of the growth was deducible from the following facts, namely, the cavity was lined with a single layer of cells like those which form the epithelial lining of the vessels; in the general wall many points of calcareous deposit existed; the inner surface was divided into numerous and intricate spaces; the fluid contained numerous blood corpuscles and crystals; while neither inosite nor succinic acids, both of which constantly occur in hydatids, was found in the fluid.

Degenerations of Spleen.

The degenerations which occur in this viscus, like the transformations which occur in other organs and tissues, are in their ultimate textural changes and in their progress latent and obscure; they depend upon molecular abnormality or some perversion in the assimilative functions, and some vice in the vital endowment of the part which is doubtless referable to a more general cause, and it is most probable that the first morbid condition takes place in the blood. It may be that there is an albuminoid conversion whereby oil is generated in the circulation, to the decrease and supplantation of normal nitrogenized materials, and hence they form the fatty decay; and that some analogous fundamental error in the vital fluid disposes to fibrous, calcareous, and various other products. These changes are of slow and chronic nature, and the substitutions which they effect are necessarily followed by the more prominent

[1] Archives de Physiologie, Aug. 1876.

and cognizable phenomena of impaired function.

Fatty degeneration of this gland is sometimes found in association with that change in the heart, liver, and kidneys. There is then seen an excess of oil molecules in the textural and vascular formations. The parenchymatous substance more readily breaks up under the fingers, and according to Rokitansky the blood contained in the vessels is frequently of pale red color and is more serous.

In the *fibrous degeneration* of this gland there is a fibrinous crasis, and certain thickenings and depositions eventuate; according to Henle, they are produced out of an effused plasma and by the nuclei developing short fibres whose union renders them more complete. Compression and atrophy of adjacent textures will be proportionate to the sum of these formative materials. The septa as well as the splenic capsule enlarge in volume, but in the latter the alteration is the most marked. The trabeculæ are rendered stronger and tougher, and thus the gland possesses greater power of resistance, and the tunics look more opaque. Recently, a man aged sixty-five was admitted into the Tunbridge Wells Infirmary, and he died of a low form of pneumonia. On inspection the house-surgeon, Mr. Cleland Lammiman, discovered the Spleen to exhibit the notable appearance of fibroid transformation. The gland had assumed the renal configuration, and the fibrous covering throughout was of dense, white structure, the eighth of an inch thick, and in the parenchymatous substance were found two hard, unyielding fibroid deposits. Gyot relates the case of a man who in early life had had intermittent fever, and after whose death dissection discovered this organ to be covered with a gelatino-fibrous network, and the microscope showed an abundance of fusiform and stellated cells, and other elements which enter into the cartilaginous structure. This kind of degeneration is more common to this gland in those who have had acute splenic inflammation, and in the aged it is sometimes met with as one of those heterologous changes incident to middle and advanced life.

The next pathologic product of which I shall speak, and one which is sometimes observed in this organ, though not so commonly as in the liver, kidneys and lymphatic glands, is that known as the *lardaceous* or *amyloid* substance. Perhaps in the strictness of technical language it can hardly be called degenerative in the same sense as we employ that term in description of the fatty change, when there is absolute substitution of the sarcolin within the sarcolemma; but this adventitious substance by its presence destroys healthy tissue and supplants it, and therefore the results are so analogous that I now refer to it under the present head. It is of albuminoid nature, and according to Wilks its appearance implies a long-standing and deep-seated cachexia, and a foregoing caries or necrosis of bone which has originated in tuberculosis or syphilis. According to the last-named authority, the substance when incised is semi-transparent, and presents the appearance of wax and lard combined, yet it is not fat, nor wax, nor gelatine, but, as Virchow describes it, the product is a peculiar albuminous compound. According to Frerichs and Murchison it is rarely associated with fatty degeneration in phthisical subjects. Dickinson, founding his opinions on the experiments of Hasse and Lehmann, as well as from clinical observation, attributes the cause of this deposit to a loss of albumen and alkali from the blood; and is consequently of opinion that suppuration and albuminuria, and not phthisis or syphilis, are the main causes, and says it is followed by an excess of fibrin in the blood. There are no symptoms during life whereby this substance can be positively diagnosed; but in certain instances of protracted and suppurative caries, when the liver is large, and at the same time the lines of splenic dulness are exceeded, it may be suspected to exist. When after death it is found in this gland, the deposit has in nearly all cases been discovered also in the liver and kidneys. According to Gairdner the lardaceous or amyloid condition is characterized by an increase of firmness being given to the organ; it is waxy looking and the Malpighian sacculi are transparent and distinct. Aikin, in describing this lesion, says the gland is enlarged, and has a swollen aspect, that it feels of the consistence of wax and lard, and that the Malpighian corpuscles are rendered more distinguishable, being round, colorless, prominent, transparent granules, and that the pulp is greatly diminished in quantity and seems in some to be entirely absent; and this writer also asserts that, under the higher microscopic powers, the ultimate change consists of an alteration in the normal corpuscles of these sacculi, which are converted into masses of colorless, dense, homogeneous, translucent material which exhibits irregular cell forms. Busk and Huxley are of opinion that this pathologic change first commences in the arterial capillaries, that the sacculi which at the first contain normal splenic cells, at the later stage contain granular and lymph corpuscles, which ultimately pass into a waxy substance, and that at length the trabeculæ and pulp undergo a similar morbid conversion. Wilks describes three conditions incident to this viscus which are connected with the lardaceous disease, but says that only one of these

ought strictly to bear that name. In the true affection he says that round translucent bodies occupy the place of the Malpighian corpuscles, looking like millet seeds, but never encroaching upon more than half of the splenic pulp; that the adventitious product confers some amount of enlargement and density, and that it is not only deposited in these corpuscles, but surrounds the smaller arteries and the trabeculæ. In the second form, according to this pathologist, the same kind of translucent substance looks as if melted tallow had been poured into the cellular structure in an ill-defined and incidental manner, and he believes it to be of strumous origin. The third description given by this physician is of a whitish-yellow soft material deposited in the gland in irregular masses, and which is connected with enlargement of the lymphatic glands. Some have named this pathological state of the organ *sago spleen*. The application of weak tincture of iodine when brushed over sections containing these bodies produces a brown color, which is characteristic of the lardaceous substance. An apt illustration of lardaceous spleen is given by Dr. Hilton Fagge[1] in the instance of a man who died of Bright's disease. He had voided about four pints of urine daily, which was of light specific gravity and which contained a large quantity of albumen. Inspection revealed proofs of syphilis; there were small soft nodes beneath the pericardium, and the liver contained whitish-yellow tough gummata with soft mucoid centres. Several of the viscera were lardaceous, the liver yielded a slight and partial reaction with iodine, and the right supra-renal capsule was affected with this change in marked degree. The Spleen weighed ten and a half ounces, was highly lardaceous, and presented the appearance of sago-spleen. It also showed whitish-yellow patches of irregular form, and all reaching the surface; on section they were more or less wedge-shaped, like infarctions, and gave a reaction with iodine. On section their cut surface was of dull yellow, with some grayish, translucent parts. They were portions of the lardaceous change in a state of fatty degeneration. Wilks and Moxon say this morbid change is not confined to the small bloodvessels, but extends to the lymphoid structure, which composes the parenchyma of the corpuscle. The lardaceous and amyloid matters are always found together in the specimen examined.

Hodgkin was the first to point out the fact of enlargement of the absorbent glands in connection with a peculiar white suet-like deposit in the splenic pulp, and which, although it bears a resemblance to lardaceous disease, cancer and tubercle, is certainly identical with none of those products, and which by its destruction of the surrounding healthy tissues may with some propriety be considered malignant, and this organ is its most usual seat, though it is occasionally found in the liver and other of the solid viscera. In the affection more particularly referred to the lymphatic glands become very large, with great uniformity of structure, and their enlargement precedes, it may be for a long time, the splenic affection, nor is there in them a tendency to suppurate. These white bodies located in this viscus are distinct and well-defined, and the more obvious conditions are splenic enlargement, with anæmia and anasarca. The splenic corpuscles which possess this deposit are, as before noticed, in the blood-making functions closely related with the absorbents, and this disease originating in the lymphatics, it can be well understood would, in organs possessing kindred functions, be exemplified in the Spleen. Payne not long ago published a good illustration of this affection in the case of a boy ten years of age, who during life had presented himself with enlarged Spleen, the organ reaching from the seventh rib to the crest of the ilium vertically, behind into the lumbar regions, and in front almost to the mesial line. On dissection this viscus was discovered to contain numerous tumors of the kind called lymphadenoma and infarctions, and the lymphatic glands were similarly affected throughout the body, some containing caseous matter which caused them to be regarded as of a scrofulous nature.[1] A youth of eighteen was admitted into St. Mary's Hospital, under the care of Dr. Sibson, and died some weeks after admission. The lymphatic glands generally were much enlarged. The Spleen was hard and large. On its surface were several projecting masses, and on section the organ was mottled with white masses. This diseased product on being microscopically examined was composed chiefly of round cells, of spindle-shaped cells, or what appeared to be free nuclei.[2] It has been shown that in these tumors polymorphous cells, fibro-nucleated tissue, and an amorphous albuminoid material may coexist in the same case. Dr. Hilton Fagge showed an enlarged spleen and lymphatic glands at the Pathological Society.[3] A large, heavy woman had been quite well until two years previously. She then began to lose flesh, and abscess formed in the left groin. Inspection showed the glands throughout the whole

[1] Trans. Path. Soc. vol. xxvii. 1876, p. 325.

[1] Path. Soc. Trans. vol. xxii. p. 278.
[2] Ibid. vol. xix. p. 401.
[3] Nov. 4, 1873.

body to be enlarged, with tendency to the suppurative condition. Disease had commenced in the uterine appendages. The Spleen weighed twenty ounces, and in it were a number of large masses the size of a walnut containing a cheesy looking substance. There being some evidence of syphilis it is presumptive that the cause of these morbid changes were referable to specific origin. Wilks, in speaking of this diseased condition, says its peculiarity is in the glandular system being first affected, and the Spleen afterwards becoming involved; and he remarks that it is possible for the propagation to take place in the course of the lymphatics, and the reason why the splenic corpuscles are affected is their intimate connection with the absorbent system. He also states that the adventitious substance when examined by a microscope shows, when taken from the lymphatic glands, an abundance of cells scarcely distinguishable from the normal secreting bodies with more or less fibrous tissues. This adventitious substance, which pathologists have variously named as lymphoid or adenoid or as lymphadenoma, bears the most resemblance to tubercle, and has doubtless been mistaken for that deposit. These anomalous substances are mostly found in the vicinity of bloodvessels, and are not unfrequently surrounded by a rusty-looking product, which appears like blood which has undergone some morbid change. Sometimes these little spots are very hard, and without any appearance of central disintegration or softening. In the liver the material is much tougher and fibro-nucleated, whilst in the lungs, Spleen, and kidneys it is composed mostly of cells which resemble somewhat those of tubercle.[1]

Syphilitic Spleen.

Syphilis affects the Spleen as it affects the other solid abdominal viscera; and since the extent and nature of the ravages of that complaint are now better known to the pathological anatomist than was formerly the case, it is now admitted that no organ or tissue possesses an immunity from this specific affection. The liver is more frequently the seat of this disease than this viscus, and when the Spleen does give evidence of the lesion, the liver as the rule presents a similar pathologic appearance. In some examples there may be partial or more general splenitis, in which a low form of inflammation is exemplified, implicating a greater or less area of the fibrous capsule and serous covering, as evinced by opacity, thickening, vascularity, effused products and adhesion to continuous parts. A debased lymphic exudation, or, as it has been called, an albumino-fibroid material, is formed in the parenchyma of the gland, sometimes towards the centre, in other instances near the surface; and the microscope reveals granular elements in the course of retrograde evolution. When syphilitically affected, the organ is very commonly enlarged; hyperæmia, a consequence of the morbid change, tends to tumefaction, and infarction institutes the inflammatory phenomena with effusion and increase of volume. Those gummata which are met with on section are roundish or circumscribed patches, and may be singular or in great or less numbers; according to Lancereaux, they are seen as whitish or yellow-looking nodosities, being frequently deep seated, and quite characteristic of their specific origin. They greatly resemble the localized infiltrations from this cause in syphilitic liver. Sometimes the cut surface looks red and shining, and the gland at the same time has acquired density, as ascertained on pressure being made by the fingers. Induration is the most usual alteration; but in some instances the viscus is rendered soft and pasty to the feel. One of the best descriptions of the syphilitic state of this gland is that given by Virchow. "Under the influence of a moderate hyperæmia," says he, "some parts of the splenic parenchyma become tumefied; sometimes deposits are formed in one or other of the lobes, sometimes the change extends irregularly throughout the whole organ. The affected parts are hard when cut; they appear darker, drier, and more consistent. Sometimes they are of a blackish-red color, and resemble hemorrhagic deposits, and it is even difficult to distinguish them from inflammatory congestions. Later on the redness disappears, especially at the centre; the tissue of the organ, while becoming drier and harder, takes on a paler color; sometimes, on the contrary, it is of a grayish red. From this moment the augmentation of the conjunctive tissue is evident. At the points where the change takes the form of a deposit there is afterwards seen a retraction or thickening, and a cicatricial depression, as we have seen in the syphilitic lesions of the liver, the testicle, and the iris. White and thickened in such cases, the fibrous capsule of this gland generally adheres to the diaphragm." In addition to palpable enlargement, the most marked event is perisplenitis, the symptoms of which, however, are generally masked or ill-defined and localized. Dr. Gee says that enlargement of the Spleen in children the subjects of congenital syphilis is about in the relative proportion of one-fourth of the cases, that the size of this organ is some index to the degree of cachexy, and that its in-

[1] Guy's Hospital Reports. Third Series. Vol. xi. p. 64.

creased volume continues two or three years after the more manifest indications of the specific disease have disappeared. In several examples which have latterly been published, in which splenic lesion was traceable to the syphilitic taint, the morbid appearances, as before remarked, very closely resembled that infiltrated and denser condition which has been more frequently given of syphilitic liver. And, as Diday remarks, the more attention which is now being bestowed upon visceral lesions in syphilitic children, will supply a better explanation of deaths which hitherto have been vaguely attributed to debility and the more general effects of the poison.

Tubercle of Spleen.

Tubercles are sometimes located in this gland, but almost if not always in connection with tuberculous growths in other organs, and generally in children. In acute tuberculosis Rokitansky says the viscus is swollen and softened, and more like the condition it assumes in the typhoid state. Jenner asserts that it is often the seat of tubercle in children, but only in exceptional cases in the adult. The lungs and mesenteric glands are very commonly at the same time diseased, and the tuberculous matter in the splenic parenchyma is seen in minute and scattered grains, or in isolated groups, and may vary from the size of a millet-seed to that of a pea. A patient was admitted into St. Thomas's Hospital, under the care of Dr. Peacock, who died from general tuberculosis, the meninges, lungs, kidneys, and other parts presenting miliary granulations. The Spleen weighed fifteen ounces, and was completely stuffed with caseous nodules the size of large peas, some of which were softening, and their yellowish color contrasted strikingly with the dark-colored pulp.[1] The tubercles are often distributed throughout the substance with much regularity, and they may be solid and hard; but in the course of time they soften in the centre and assume a curdled appearance, or look like cheesy substance. Billroth says that in miliary tuberculosis of this gland the parenchyma is rendered dark, hyperæmic, and extremely brittle, that the deposit is in the splenic tissue, and that the veins in the vicinity of the tuberculous matter contain a large number of cells with large nuclei very similar to those found in typhus spleen.

Cancer of Spleen.

Splenic cancer is exceedingly rare, and is seldom if ever discovered alone. Jenner bears testimony to its rarity, and thinks he has never seen it except in conjunction with the same growth in other organs. A specimen was recently exhibited at the Pathological Society of what was supposed to be primary splenic cancer, and which occurred in the practice of Dr. O'Connor. A most careful search had failed to discover malignant growth in any other part of the body. The Committee on Morbid Growths, who microscopically examined the product, pronounced it to be carcinomatous, but, as they observed, there had been effusion into the left pleura, with no obvious conditions preceding that event, and there might have been a small and primary mediastinal tumor, thus lessening the probability of this case being, as it had been supposed, an almost unique example of primary splenic cancer. In some cases the Spleen and lymphatic glands have both been cancerous, and some have attributed such coincidences to the fact of functional alliance between those organs. It may be found of the schirrus variety, but it is far more likely to be met with in the encephaloid form, such as we discover in the liver. The authority now quoted illustrates carcinoma of this viscus in the instance of a patient under his care in the hospital. A woman was admitted for schirrus of the breast and rectum, and she presented all the conditions of the cancerous cachexia. A large tumor occupied the left hypochondrium and passed up under the ribs, and it was hard, with a sharp edge, which met the margin of the thorax at a right angle. Its dulness extended up to the level of the nipple, and the lower edge was on a level with the umbilicus. It was situated just beneath the parietes, moved up and down with the movements of respiration, and could be pushed a little from side to side by the hands behind and in front of it. Its surface was irregular, and in the anterior border several distinct nodules could be felt; and the increase of dulness, the hardness and irregular surface, and the nodules were precisely the same in kind as are those which are common in carcinoma of the liver.[1] Sometimes the deposit may be central, and neither the configuration nor the bulk of the organ be materially altered; and it is then seen in rounded deposits. The malignant growth becomes invested with a fibrous sheath, and in some cases the product becomes disintegrated within this covering. Mr. Maurice exhibited at the Pathological Society a case of colloid cancer of the Spleen in a man aged thirty-six, and it was remarkable for the very large size which the organ acquired by the presence of malignant deposit. At the same

[1] Med. Times and Gaz. vol. ii. 1873, p. 22.

[1] Brit. Med. Journ. Feb. 13, 1869, p. 138.

Society Mr. Durham some time ago showed a specimen of splenic cancer in which the organ weighed twenty-four ounces. Its surface presented small whitish, granular growths in the capsule, and the same bodies extended into the parenchyma, varying in size from great minuteness to the size of a vetch-seed, and the section resembled Virchow's illustration of lympho-sarcoma of this gland. When detected in this organ it has not unfrequently occurred, on minute investigation, that the lumbar glands here show evidence of the cancerous product. *Melanosis* may occur in the splenic substance, as it may occur in nearly all other organs of the body. Though it cannot strictly be considered a morbid product in itself, yet this black matter is secreted from the blood very commonly when there is malignancy, and it is under such circumstances that it is found in this viscus.

Other Anomalous Growths.

Sometimes on free sections being made in this organ, masses of *yellow fibrinous matter* of uniform consistence are discovered, which Bright thought to be the remnants of apoplectic clots, but which more recent pathologists would regard as the remains of extravasations produced by emboli. Moxon examined a Spleen in which there was a circumscribed patch presenting the ordinary condition resulting from embolism, and a plug of pale fibrin filled the arterial branch which went to this part of the organ. Nodules and masses of yellow opaque matter are sometimes found in this viscus associated with some foregoing and general disease in the system. Dr. Douglas Powell related the case of a young woman who died of tubercular phthisis in the Brompton Hospital, illustrative of what is now affirmed.[1] On the surface of this gland were many spots varying from the size of a pea to a large filbert, and on section these nodules were found to be firm, opaque, yellow globular masses imbedded in the splenic parenchyma. The vessels were not blocked, as each mass was invested in a thin fibrous capsule, or on minute examination these depositions were seen to consist of a fine fibrous stroma, the fibres of which were granular, and free fatty granules were also detected. They doubtless resembled the cheesy matter known as a product in scrofulous inflammation, and which sometimes bears a resemblance to those gummatous formations which in more external deposits are noted in subjects who have labored under the syphilitic cachexia. Balfour and Grainger Stewart not long ago published a case of ascites with enlarged Spleen, in which the splenic vein was atheromatous, and in which there were several true aneurisms. The fibrous tunic has been discovered three or four lines in thickness, and occasionally between the serous and fibrous coverings ossific laminæ have been found. Bright once saw, on section of the organ, two pieces of bony matter imbedded in its substance. Valsalva discovered the coats converted into a bony hardness; and Littré exhibited to the Royal Academy of Sciences in Paris a specimen of this gland, the whole substance of which had become osseous. These last-named changes are found nearly always in old people. Rokitansky says they are often noticed as the ossification of fibroid laminæ, or as the cretified fibrine in the cellulo-fibrous callus. Bampfield narrated a remarkable case of ossification in which from the centre of the viscus arose a spherical bony tumor as large as the head of a fœtus seven months old, and it contained seven ounces of serum, in which were floating bright, micaceous, chalky particles. Calcareous deposits have been noticed as free concretions or phlebolithes in the venous channels of the gland. Morgagni recorded an instance in which a calculus weighed twenty-one drachms; and in the Acta Parisiensa, an example is given in which the internal structure of the Spleen was found bony without any other mark of disease. It has been observed in some cases, in which the organ has been larger, and more especially when chronically enlarged, that *White Patches* have been produced on its surface and most commonly on the convexity. The upward and downward motion of the viscus during the act of respiration in such instances, causes local irritation, and thus gives rise to fibrinous thickening of the capsule. White patches of the same kind are sometimes seen on the liver, but more frequently, on account of its greater motion, on the ventricles of the heart. Their extent and amount of thickness, of course, depend upon the degree and direction of the friction to which the organ has been subjected. *Cicatrices*, like the old seams of former incisions or ancient scars, are occasionally discovered on the splenic surface after death, and such marks leave no doubt as to their having been produced by previous injuries.

Dislocation and Malformation of Spleen.

Dislocation of the Spleen is another and remarkable circumstance, of which a few instances can be found recorded in medical literature. Its displacement may be

[1] Trans. Path. Soc. vol. xx. p. 366.

congenital or caused by disease. In absence of the diaphragm, and in rupture of the diaphragm, it has been found within the thoracic cavity. Haller, in the case of a child, saw it lying by the side of the urinary bladder. Desault beheld it in the right side of the thorax. Riolanus on two occasions witnessed it adherent to the uterus. Ballonius once found it attached to the bladder. Dunglison discovered it resting on the brim of the pelvis, retaining its peritoneal and vascular connections, and freely moving in all directions. Wilks and Moxon saw a spleen, of twenty-four ounces weight, entirely dislocated and lying in the pelvis, where it might have been mistaken for ovarian tumor. Küchenmeister has collected several cases in which this organ has been found displaced. Rokitansky has given three examples. The first of which he speaks was in a young man, and the gland was found upon the right ilium attached to a twisted pedicle, and the pedicle consisted of the pancreas and splenic vessels. The second case was in a phthisical woman, in whom it had sunk down into the left iliac region, being joined to a long pedicle and to the omentum. In the third illustration the organ was adherent to the sigmoid flexure and small intestine, and it was the size of a goose's egg. A remarkable case was exhibited to the Société d'Anvers by M. Kurns. A woman, aged forty, was admitted into the hospital, apparently suffering from strangulated left inguinal hernia, and she had a tumor of about the size of the fist in the iliac region. Vigorous treatment was resorted to, but without success. On examination after death adhesions were found to have formed between the omentum and the intestines, and flakes of lymph in several positions. The tumor was found to be the spleen held by pseudo-membranous bands to the abdominal wall, and also to the intestines, which were very much dilated beneath it. The splenic vessels formed a large cord leading to the left hypochondriac region, but the substance of the organ was normal. Elongation of the ligaments is the cause of this displacement. Twisting of the pedicle compresses the nutrient vessels, and atrophy of the viscus results. It has sometimes occurred in examinations after death that this organ has presented a shape and configuration rendering it unlike its natural appearance. It has been found thick and round, and the anterior edge hardly or not at all defined. Sometimes it is more spread out and thinner than normal; or it may be symmetrical and unnaturally small, and it may show rudimentary lines as if two or more Spleens had coalesced. Several pathologists remark upon its occasionally having been seen fissured and lobulated. Riolanus noticed this fact, and records that he had thus seen it double or threefold, and Barthalonius asserted that he had seen it in five portions.

Supernumerary Spleens.

Sometimes one or two more separate and distinct Spleens have, on dissection, been discovered. They have been observed small as a sparrow's egg or a filbert, and, on examination, their internal structure has resembled that of the larger organ with which they have been associated. Fallopius saw three Spleens in one subject, and Cheselden, Cruveilhier, Hulke, Bright, and others mention having met with a plurality of this gland. Splenules, which are far more commonly met with, are but portions of the larger Spleen.

General Diagnosis.

It should be held in remembrance from what has already been said in this article, that splenic diseases in this country are by no means so commonly met with as, from the writings of the older authors, it is evident was formerly the case. The reclamation of waste lands, the better and far more extensive drainage, and an improved system of agriculture have told most favorably in the prevention of intermittents and remittents, and consequently in the diminution of splenic diseases. Still, from time to time the miasmatic affection of this gland comes before almost every practitioner of medicine, and the general rules of observance for the detection of the maladies incident to the viscus may now concisely be recapitulated. That condition of the countenance, and those peculiar and more objective symptoms exemplified in the patient, which are so commonly seen in those laboring under one or other form of this organ's lesion, and which are said to enter into the condition constituting what is termed the splenic cachexia, point significantly to the kind of ailment which obtains. The dull, listless, apathetic expression; the dirtyish yellow-hued color of the skin; the pale and bloodless eyes; the puffed face; and the exsanguine lips, tongue, and gums, confer striking evidence, and which cannot fail of a correct interpretation. The facts elicited in clinical history generally give etiological particulars which are in close accord with the nature of the symptoms; and more accurate examination and attention to the physical signs add positiveness to diagnostic inference. In the young, and those whose constitution has not been undermined by long residence in tropical climates or aguish districts, the cachectic state may be less pronounced; still, whenever the functions

of this organ are in any way interfered with, the blood-making process cannot be normally carried on, and a greater or less degree of anæmia is produced. In certain of its organic and chronic diseases, more especially when there is manifest enlargement, the diagnosis is not difficult; but in some other forms considerable doubt may be left in the mind of the physician, and even after much painstaking and patient investigation. In acute splenitis, when the tunics and convex part are inflamed, the diaphragm not unfrequently becomes implicated, when there are sharp pains, cough, and dyspnœa; the surface is then hot and dry, and the thermometer indicates elevation of temperature, the pulse runs high, and peritonitis may, and mostly does, in circumscribed manner obtain; but the tenderness on pressure is not diffused, or only in exceptional cases, over the abdomen. The patient cannot lie on his right side; he then reclines on the left, or involuntarily assumes a diagonal position. On palpation there is more or less of tenderness over the splenic area, and often on movement of the trunk from the right to the left side there is acute pain. When there is enlargement of this viscus in periodic fevers, the diaphragm may be so pushed up as to compress the base of the left lung; but percussion over the dull thoracic part does not give that dead sound which, when it obtains, indicates fluid in the lower portion of the chest, and the dull space is not varied from the former cause by the altered position of the trunk. The breath-sound is absent altogether; there is no ægophony; no splash is heard on concussion; the dulness is continuous below the false ribs; and palpation generally discovers the round, smooth, or notched edge of the organ. This disease is distinguished from hepatitis by the absence of jaundice and the abnormal color of the excretions; in liver complaints the patient lies on or inclining towards the right side, and digital examination and percussion mostly confer a correct knowledge of the enlargement of the liver. When the left line of the liver exceeds its normal boundaries, the dulness extends to the right hypochondrium, and it may be held as a rule that in nearly all cases the right lobe is also diseased. Splenic enlargement is known from pleurisy and pneumonia by the non-existence of those physical signs and more general objective or subjective symptoms which are so indicative of these respective affections. There is not the pleuritic pain at some point of the thoracic wall, the pulse is not so quick and full, nor is the temperature so high, as when that serous membrane is inflamed. The absence of the dusky hue of the countenance, the pneumonic sputa, and the shallow, hurried respiration, which are so characteristic of inflammation of the pulmonary substance, are guiding negative facts. It is distinguishable from pleurodynia by the seat of pain and unaffected circulation, more sudden supervention and transient character of that complaint. It differs from nephritis, because in kidney lesion the pain is localized more in the lumbar region, and renal mischief can with certainty be detected by the ordinary tests employed in examining the urine. It may be known from encysted and movable kidney by the dulness being continuously traced up under the thorax, and not towards the spine; and, too, by the less mobility of the mass than there is in these alterations now named in the kidney. It does not agree with ovarian tumor, from a general review of the more prominent circumstances associated with ovarian disease. In ovarian tumor there is resonance, in the earlier stages especially, between the upper edge of the tumor and the false ribs, and the enlargement is lower in the abdomen and traceable into the pelvis. It varies from impacted colon, because in the last-named affection the percussion dulness can be followed transversely and in coincidence with the colonic course; there is then often a configuration which to the touch varies from day to day, and a large injection will mostly settle the question. In aneurism of the aorta the pulsation and bruit, and not unfrequently the greater or less degree of paralysis in the legs, tell with much distinctness of that grave disease. In cancerous growth of the omentum, the tumor is flat and hard, and widely spread over the abdominal cavity, and generally there is great and lancinating pain. In carcinomatous enlargement of the cardiac end of the stomach there is generally much sickness, with sharp stabbing pains and sour eructations. In splenic disease there is, as a rule, a history of marsh fever, which denotes the true nature of the malady.

The indications of suppuration are flushes and rigors, throbbing, enlargement, wasting, and declension of strength, a dull aching rather than acute pain in the left side, and without the symptoms of empyema, phthisis, liver disease, suppurative nephritis, lumbar abscess, or ulceration of the bowels. In mere congestion the pulse is usually slow and large, nor is there any marked degree of pyrexia. In leucocythæmic hypertrophy there may be no history of malaria, and the organ extends downwards and forwards rather than transversely; sometimes this kind of splenic tumor half fills the abdominal cavity; and in no other lesion of the organ does it assume such enormous dimensions. Blood taken from a patient under such circumstances and

examined by the microscope shows the inordinate number of white cells, which render it different from mere anæmic blood, and which so markedly characterize that affection. In anæmia there is deficiency of red corpuscles, and in chlorotic females the heart is feeble and the liver generally engorged. In the disease now known as anæmia lymphatica, the blood-globules are pinkish, in diminished quantity, and the lymphatic glands are large. The chief and more obvious diagnostic appearances of splenic disease in children are the marked indifference which they exemplify to things around them, the neglect of, and little inclination for, childish amusements, the blanched conjunctivæ, the sickly, pale, waxen complexion, and the loss of flesh and strength. The increased splenic dull area is often distinct, and the abdomen is full and round, and the bowels irregular. On examination of the blood there is deficiency of fibrine and red corpuscles. Some writers have said the face of the child often presents a creole shade, which is not the ochery color of icterus, nor yet the discoloration of chlorosis, but a shade quite special, which, in no very felicitous phraseology, has been called bluish icterus. For more precise details relative to diagnostic differences, and those special symptoms whereby the various lesions of this viscus can be recognized, the reader may recur to what has already been said under the head of Symptomatology.

General Prognosis.

In forming a prognosis relative to the disease to which this organ is liable, many and varied circumstances should be taken into account, and the diagnostic conclusions will very greatly determine the opinion to be formed as to future eventualities in the course of its respective maladies and the ultimate result. The clinical history and various antecedent occurrences must in all instances necessarily modify the decision at which the physician arrives, and without a knowledge of such foregoing facts no right conception of the issue can be entertained. The probabilities of recovery will depend much upon the kind of complication, the vital powers of the patient, the longer or shorter duration of the affection, and the causes by which it has been produced. When coexistent with other diseases, the nature and degree of severity of such diseases should be duly regarded and the influence which they are likely to have upon the lesion of this viscus. In sthenic types of splenitis or those of unbroken constitution, and when it is the accompaniment of periodic fever, the prognosis is favorable. In pernicious remittents and in adynamic fevers, when there is great contamination of the blood, when the organ has become gradually large, and seems little amenable to treatment, and when there is hepatic, cardiac, or renal complication, with ascites or anarsarca, the prognosis is unfavorable. In marked and chronic enlargement, and when the gland is soft and resistless to the touch, and when it comes down below the costal edge and it is preternaturally hard, such changes cannot otherwise be contemplated than as being of grave import. Such instances as are accompanied by hemorrhagic discharges, more especially by epistaxis and hæmatemesis, generally indicate a serous lesion of the organ; or when there is a persistent diarrhœa with occasional melæna in patients much emaciated, and particularly those in whom these symptoms are in association with general dropsy, there are well-grounded reasons for fear as to the ultimate issue. Again, cutaneous maculæ, vibices, and dark purpureal stainings are very unwelcome appearances. When there are decisive evidences of splenic suppuration, such condition is most ominous, as death generally follows. In simple congestion produced by marsh fever, the primary cause being removed, and a proper course of treatment pursued, recovery, as the rule, succeeds; or if the enlargement is evidently traceable to hepatic obstruction brought on by some functional or temporary occurrence, the gland may fully regain its normal size and natural functions. In leucocythæmic hypertrophy the cases mostly go on to a mortal termination, and the prognosis is then most unfavorable. In cases which are believed to be those of cysts, hydatids, and other anomalous growths encroaching upon the parenchymatous substance, the opinion cannot be otherwise than dubious and full of apprehension. In children and young people in whom has been induced splenic disease from malarial poison, change of district or climate gives great hope of restoration to health.

Conclusion.

In conclusion, it may be remarked that miasmatic enlargement and other morbid states of this viscus, as it has already been stated, are amenable to remedial measures, but certain conditions of its chronic hypertrophy cannot be influenced by medicine. Under a due consciousness of this fact the extirpation of the gland has been practised. It is recorded by Gustav Simon[1] that in the case of a young Neapolitan it was removed by Zaccarelli in

[1] Gustav Simon, Die Extirpation der Milz am Menschen. Giessen, 1857.

1549. A medical friend of my own, who had long resided in India, told me that the operation had occasionally from remote times been had recourse to in that country, but the want of success had led to its discontinuance. It was done by Quittenbaum of Rostock, in 1826; by Kückler of Darmstadt, in 1855; and in November, 1865, it was performed by Spencer Wells. The arguments which have been advanced in favor of the reintroduction of this terrible measure are that its removal from the lower animals has apparently been followed by no ill effects in the system; and that it has been removed in the human subject by accident, as narrated by Morgagni, when the individual subsequently lived five years; and finally, that it may be atrophied to an exceedingly small size without life being sacrificed or the health materially injured. Such considerations are likely to weigh much in these days when the abdominal cavity can, as it is so constantly shown, be freely opened with the greatest success. The patient operated on by Wells was a married woman, who had had children and was thirty-four years of age, and who was considered to be dying of splenic disease, such being her only ailment. In October, 1865, the viscus extended as high as the seventh rib, and it reached down so low into the pelvis that it could be felt through the walls of the vagina; and the line of union between it and the left lobe of the liver could not by palpation or percussion be determined, nor were there as accompaniments either dropsical tendency or glandular enlargement. The gland rapidly increasing and the patient losing ground, Sir William Jenner was called in consultation, when he detected a soft anæmic murmur, over the cardiac region; and on microscopical examination excess of white blood-globules was discovered. Death being inevitable if the case were left alone, the operation was decided upon, and it was terminated in thirty-five minutes under chloroform. She recovered from the shock, but died of pyæmia on the seventh day. The cadaveric inspection revealed effusion into the pericardium and both pleural cavities, but no peritonitis beyond the vicinity of the wound, and no hemorrhage. The organ weighed six pounds four ounces, avoirdupois, and it measured eleven inches in length, eight in breadth, and between three and four in thickness. Kœberlé lately excised the Spleen in Spain, but the patient died from hemorrhage. Its ablation not long ago was successfully effected by Péan. Mr. Bryant excised it in June, 1866, the patient being a young man of only twenty years of age, who for a year and a half had labored under its leucocythæmic enlargement. The tumor filled nearly the whole of the left side of the abdomen. The operation was easily performed and the tumor readily withdrawn from the cavity, but the patient survived only three hours, the cause of death being hemorrhage into the abdomen, not, as it seemed, from the pedicle, but from a smaller vessel lacerated during the process of separation of the adhesion. The last-named surgeon a second time removed it in a leucocythæmic woman, aged forty, and in this as in the preceding instance hemorrhage caused the fatal result, the patient bleeding to death in fifteen minutes.[1] Splenotomy is now very generally regarded as unwarrantable. For more ample details on this peculiar question the reader is referred to the more recent works on surgery.

SPLENIC LEUCOCYTHÆMIA.

By W. R. Gowers, M.D.

Synonyms. — Leukæmia, Splenæmia, Virchow; Leukæmia lienalis; Splenopathia leucocythæmica, Magnus Huss; Diathèse lymphogène à forme leucémique, Jaccoud.

Definition.—Leucocythæmia[2] (λευκὸς, *white*, κύτος *cell*, αἷμα, *blood*) is a chronic

[1] A case in which the removal of the Spleen was followed by recovery is mentioned in the London Medical Times and Gazette, Dec. 7, 1867.—H.]

[2] The name (leucocythæmia) proposed by Bennett, is preferred to that of Virchow (leukæmia) on the ground that, as pointed out by Parkes, the blood is never white, and rarely approximately so, that the term white blood had before been applied to a totally different condition, and that the term of Ben-

disease characterized by a considerable and permanent increase in the number of the white corpuscles of the blood, the tint of which is in consequence paler than usual. The change in the blood is in most cases accompanied with enlargement of the spleen, alone or associated with enlargement of the lymphatic glands; sometimes also with a change in the medulla of bones; very rarely with the change in the lymphatic glands alone, and still more rarely in the medulla of bone alone. A slight increase in the number of white corpuscles exists in many diseases, and has been termed "leucocytosis." It is not usual to regard a case as one of leucocythæmia, unless the proportion of white corpuscles is considerable and permanent.

NATURE AND RELATIONS.—The change in the blood which constitutes the characteristic feature of leucocythæmia, a considerable and permanent increase in the white corpuscles, is associated in all, or almost all, cases with two other conditions, a diminution of the red corpuscles of the blood, and an overgrowth of adenoid tissue in certain organs of the body. These two conditions characterize also other forms of disease not accompanied by an excess of pale corpuscles in the blood. The diseases characterized by these conditions (the adenoid overgrowth with anæmia, or leucocythæmia, or both) have points of identity fundamental and numerous.

The tissue known, since the description given of it by His, as "adenoid," consists of lymphoid corpuscles imbedded in the meshes of a "retiform" stroma. Normally it is located chiefly in four situations—in the spleen, the lymphatic glands, the medulla of bone, and in certain glands of the alimentary canal (follicles at the base of the tongue, tonsils, solitary glands of the stomach, solitary and Peyerian glands of the intestine). An overgrowth of this tissue, with more or less change in its characters, may occur in one or several of these situations, and in each may be associated with simple anæmia or with leucocytal excess. In most instances there may be also a new growth of adenoid tissue in situations in which normally no tissue of this structure can be recognized. From the various combinations of these pathological elements there result diseases of widely different aspect. Between some of these the distinctions are considerable, but between all the members of the series intermediate forms exist, so as to justify their classification into one group of "lymphatic" diseases, and to render their separation a matter of some difficulty.

This difficulty is increased by the circumstance that we are ignorant of most of the conditions on which the pathological differences depend. We are ignorant of the precise relation between the growth of the adenoid tissue and the blood state. We know little of the origin of the symptom which has usually been taken as the guide to classification, the presence of an excess of white corpuscles in the blood. As a striking and remarkable characteristic, it was naturally seized as the most salient, if not the most important, feature of the morbid states in which it occurs, justifying the separation of these from other conditions. But a wider observation has shown that each of the pathological conditions mentioned above may or may not be accompanied by this excess, without, so far as our observation goes, any necessary pathological difference in the recognizable characters of the tissue changes. Having regard therefore to this similarity of the conditions in which leucocythæmia does and does not occur, and in our ignorance of the precise conditions on which it depends, it seems unscientific to separate altogether the morbid conditions in which it occurs from those, otherwise apparently the same, in which it does not occur. To do so is to elevate to the rank of a disease that which, according to our present means of observation, is only a symptom—comparable to that of albuminuria.[1] It seems more consistent with the principles on which the classification of disease is based, to group the cases according to their initial and predominant pathological lesion, as far as it can be determined, assuming, as their connecting character, the common facts of progressive anæmia and adenoid overgrowth.[2]

nett describes what is universally taken as the diagnostic sign, the microscopical condition of the blood. This may be marked when there is little or no change in its appearance to distinguish it from simple anæmia. Moreover, the general adoption of the word leucocyte to designate the cells which are in excess (proposed by Robin in 1855), gives peculiar aptness to the term leucocythæmia. No doubt the blood, as Virchow objects, never consists solely of leucocytes; but it is never white, as it should be if termed leukæmia. The word leucocythæmia is at least as free from objection on the score of not being literally exact, as most other designations of disease. Probably its orthography and pronunciation might be with convenience assimilated to other terms by spelling it leucocytæmia.

[1] Barth, Vigla, &c.; Bull. de la Soc. Méd. des Hôp. 1856, p. 60. Magnus Huss expressed a similar opinion, Arch. Gén. de Méd. 1857.

[2] Jaccoud has done this so completely as to describe the whole class of affections, from splenic leucocythæmia to mycosis fungoides of the skin, as one disease, "Diathèse lymphogène."

It will be found, however, that the two methods of classification lead to results which are not wholly at variance. The majority of cases of lymphatic disease present primary lesions in one of two seats of adenoid tissue, the spleen or the lymphatic glands. Out of one hundred cases taken without selection (as recorded within certain years) the spleen was the first and chief seat of disease in fifty-seven cases, and the glands in forty-three. Of the former there was a considerable excess of white corpuscles in the blood in fifty-four; and in many the excess was very great. It was absent in three cases only. (It is probable that this proportion of cases of splenic anæmia is too small and arises from such cases being less remarkable, and less commonly reported.) In the cases of primary glandular enlargement there was an increase of the white corpuscles in thirteen only, and in none of them was the excess very great. In thirty there was no excess. Thus leucocythæmia is common and often extreme in the progressive anæmia which accompanies splenic enlargement, and is comparatively rare and then slight or moderate, in cases of progressive anæmia accompanying primary glandular enlargement. The two forms of affection present, moreover, some difference in their etiological conditions, in their course, and in their termination. The division into these two classes is therefore adopted in the following articles; and as simple anæmia with splenic enlargement has been considered in the article on Diseases of the Spleen, the two forms of disease are described as Splenic Leucocythæmia, and Hodgkin's Disease, or Lymphadenosis. The rare forms with primary intestinal and medullary growth are described incidentally.

HISTORY.—Each of the elements of which leucocythæmia consists was recognized by the older medical authorities. On the one hand, cases of enlarged spleen, accompanied by the special symptoms which we now know to be common in leucocythæmia, were recorded by many authors from Hippocrates downwards; and on the other hand, examples of a peculiar alteration in the color of the blood, suggesting the admixture with it of pus, were recorded by Bichat and others in the early part of this century. The association of the change in the aspect of the blood and the enlargement of the spleen (to 10 lbs.) was described by Velpeau in 1827.[1] In 1839 a case of splenic tumor came under the care of Barth at the Hôtel-Dieu, in which, post-mortem, the blood was noted to be semi-purulent. It was examined microscopically by Donné, who found it to contain "more than one-half white or mucous globules." This observation, certainly the earliest microscopical recognition of the disease, was not published until 1855,[1] but the fact of the occurrence of this change in the blood was distinctly mentioned by Donné in 1844,[2] and referred by him to imperfect transformation of white into red globules. In 1845 two cases of this disease were published together,[3] the one by Dr. Craigie, the other by Dr. Hughes Bennett. Dr. Craigie's case was observed in 1841, and the blood, examined after death by Dr. John Reid, was found to contain "large numbers of pus and lymph cells." The spleen was greatly enlarged, weighing 115½ ozs., and the liver was enlarged to 99 ozs. There was also a conspicuous enlargement of the solitary glands of the ileum, and white spots were scattered through both kidneys. The abnormal elements of the blood, regarded as puscells,[4] were referred by Dr. Craigie to the enlargement of the spleen. He ingeniously argued from the structure of the

[1] Revue Méd. 1827, ii. p. 218.

[1] Société Médicale des Hôpitaux, Nov. 28, 1855. Vidal, Gaz. Hebd. 1856, 201.

[2] Cours de Microscopie, 1844. "J'ai plusieurs fois rencontré dans le sang de malades, des proportions considérables de globules ayant tous les caractères des globules de pus, et que j'aurais infailliblement considérés comme tels, si je n'avais pas connu d'une part, la grande analogie de structure et de forme des globules purulents avec les globules blanc du sang, et de l'autre si la nature de la maladie et l'autopsie n'avaient pas éloigné toute idée de pus circulant avec le sang," p. 197. "Un homme, dans la force de l'âge, était atteint d'une artérite qui affectait spécialement les vaisseaux des membres inférieurs; les deux jambes étaient la siége d'ecchymoses, de phlyctènes gangreneuses, etc. Le sang de ce malade présentait une telle quantité de globules blancs, qu'en raison même de la nature de son affection j'étais porté à croire que le sang était réellement mêlé de pus; mais, en définitive, il ne me fut pas possible de constater une difference tranchée entre ces globules et les globules blancs. . . . Je suis plus porté à croire aujourd'hui que l'excès des globules blancs tient plutôt au défaut de transformation de ces globules en globules rouges, à une sorte d'arrêt dans l'evolution du sang, qu'à la presence de globules d'une nature etrangère comme ceux du pus" (p. 135). He also (p. 99) attributed to the spleen the function of converting the white into red globules, as Hewson had done in the preceding century.

[3] Edin. Med. Journal, October, 1845.

[4] According to a statement made after Dr. Craigie's death by Dr. Hughes Bennett, who claimed the discovery of the disease, the significance of the change in the blood was not appreciated, or indeed its occurrence remembered, by Dr. Craigie, until it was found in the second case by Dr. Bennett.

organ that in chronic inflammation, pus-corpuscles would pass into the blood as soon as they were formed, instead of accumulating in abscesses. In the case published by Dr. Bennett the change in the blood was also found by him after death. He also regarded the corpuscles as pus, discussing and rejecting the hypothesis that they were white blood-corpuscles. He attributed them to suppuration of the blood itself rather than to the change in the spleen.

A month later Virchow published an analogous case in which also the blood change was only found after death.[1] He pointed out the peculiar nature of the affection, and proposed for it the name of "leukæmia," recognizing the identity of the abnormal elements of the blood with white blood-corpuscles.

In these observations the state of the blood had been recognized only after death. In the beginning of January, 1846, a case occurred in St. George's Hospital in which the liver and spleen were greatly enlarged, and in which Dr. H. W. Fuller found, on examining the blood both during life and after death, that there was a large proportion of abnormal colorless globules. He described the case at the Medical and Chirurgical Society in June, 1846. In August of the same year Dr. Walshe, at University College Hospital, demonstrated to his class that in the blood of a patient with enlargement of the spleen the "colorless corpuscles were as numerous as the colored disks." In Germany the disease was first recognized during life by Vogel in 1848.[2] In August, 1846, Virchow republished the cases recorded,[3] and brought forward many arguments to prove that the cells were really white blood-corpuscles and not pus-cells, as Craigie and Bennett had maintained. He followed this by a series of very able articles on the physiology and pathology of the blood-corpuscles in relation to the new disease, of which he described several fresh cases, and pointed out the implication of the glands in the morbid process.[4] In 1850 a well-observed case was published by Dr. Parkes.[5] In 1851 Dr. Hughes Bennett published a number of fresh cases and facts, and discussed the pathology of the disease in a series of papers,[1] which were in 1852 collected as a treatise on the disease.[2] He adopted the opinion that the cells were really colorless blood-corpuscles, and proposed for the affection the name "leucocythæmia." Since then a very large number of articles and theses on the disease have been published, of which the more important are those of Vidal[3] (collection of cases), Magnus Huss,[4] Ehrlich[5] (collection of a hundred cases of splenic and glandular disease), Ranvier[6] (researches on the changes in organs), Neumann[7] (discovery of the changes in the medulla), and Mosler (many cases since 1864, and a systematic treatise on the disease[8] in 1872). Systematic accounts have been given also by Isambert, and by Jaccoud and Labadie-Lagrave in the French Dictionaries now publishing, and to these articles copious bibliographies are appended. Other very important contributions to the subject have been made by Schreiber, Hewson, Wilks, Charcot, Friedreich, Böttcher, Müller, Ponfick, Scherer, Salkowsky, Kottmann, Waldeyer, and others, and will be referred to in connection with the subjects of which they treat.[9]

VARIETIES.—Leucocythæmia has been divided into varieties according to the

[1] Forieps Notizen, Nov. 1845.

[2] Virchow's Archiv, Bd. 3, 1849, p. 170. Several writers state that Vogel described a case, diagnosed during life, in Canstatt's Jahresbericht for 1846. I have been unable to find any ground for the assertion in Vogel's report on diseases of the blood in the volume for that year. Vogel, in his article in Virchow's "Handbuch der spec. Path. u. Therapie," Bd. 1, p. 393, gives 1849 as the date of the publication of his earliest observation during life.

[3] Med. Zeitung, 1846; Nos. 34 and 36.

[4] Archiv f. path. Anat. 1847, 1849, 1853, 1854, and Gesammt. Abhand. 1856.

[5] Med. Times, 1850.

[1] Edin. Med. Journ. 1851.

[2] Leucocythæmia, or White Cell-Blood in Relation to the Physiology and Pathology of the Lymphatic Glandular System. Edin. 1852.

[3] Gaz. Hebd. 1856; a series of papers republished as a separate work.

[4] Archives Générales de Médecine, 1857, p. 291.

[5] Ueber Leukämie, Dissert. Inaug. Dorpat. 1862.

[6] With Ollivier, Société de Biologie, 1866 and 1867; Archives de Physiologie, 1869; Histologie Pathologique, 1873.

[7] Archiv der Heilkunde, vol. xi. 1869, p. 870, and in vols. xiii. and xv.

[8] Die Pathologie und Therapie der Leukämie. Berlin, 1872.

[9] In the above sketch of the history of leucocythæmia I have avoided any discussion of the much-debated question of the priority of the discovery. Opinion on this point will depend on the view held as to what constitutes a discovery. It is certain that the disease was first fully observed by Donné and Barth, and first fully described by Craigie and Bennett. If their interpretation was less in harmony with received views than that appended to the independent, and almost simultaneous, description of the disease by Virchow, it must be remembered that modern views as to the nature of pus corpuscles render their explanation, especially that of Craigie, less divergent from the current pathology than it has seemed to be.

seat of the primary or chief adenoid overgrowth with which it has been associated. Thus we have "splenic," or "lineal," and "lymphatic" forms. To these it has been proposed to add a "myelogenic" form, in which the marrow of bone is diseased, and an "intestinal" form, in which the chief overgrowth is in the follicular glands of the intestine. "Amygdalean" and "cutaneous" forms have even been proposed, in which the chief lymphatic overgrowth takes place in the tonsils and as cutaneous tumors. But it is doubtful whether the latter are, as primary changes, ever associated with a large excess of pale corpuscles in the blood, and their distinction as forms of leucocythæmia seems superfluous. The existence of a simple myelogenic form unaccompanied with changes in the spleen or glands, and yet comparable in its course and consequences to the splenic form, cannot be considered as at present established. The primary lymphatic form is described in these articles as one of the varieties of Hodgkin's Disease.

Compound words have been employed to designate the intermediate forms which combine the characters of the supposed varieties. Thus, in the "spleno-lymphatic" form, an initial splenic enlargement is associated with glandular swellings, and in the "spleno-myelogenic" form, with changes in the marrow. The cases again in which the glandular enlargement is distinctly secondary to the splenic tumor, must be distinguished from those in which there occurs a simultaneous enlargement of the glands and spleen, cases which combine the characters of lymphadenoma and splenic leucocythæmia, and may be termed a "lymphatico-splenic," or, more accurately perhaps, a "lymphadeno-splenic" form.

ETIOLOGY.—Very little is known of the causes, immediate or remote, to which splenic leucocythæmia is due. In a minority of the cases some morbid condition or influence can be discovered to which the disease is sequential in time, and of which it may be, in some degree, the result. In the majority of cases no such antecedent can be detected; the disease comes on in the midst of good or fair health. The etiological conditions which can be traced or suspected stand in a relation to the disease which is too uncertain to allow them to be classed as "predisposing" and "exciting." It will be convenient to consider them together, beginning with the more remote.

Race has apparently little or no influence on the occurrence of the disease. It occurs in many countries, and in people of very various nationality and color. The effect of this influence must of course be kept distinct from the effect of endemic conditions.

Heredity has not yet been definitely proved to exercise any influence. In one or two cases there has been a family history of splenic disease in one or more members of the family. It was so in a case narrated by Biermer,[1] in which a child died at the age of four and a half years of leucocythæmia, and a sister suffered from an enlarged spleen and simple anæmia, and other members of the family died between one and two years of age. A still more remarkable instance is recorded by Casati.[2] Two brothers suffered from progressive increase in the liver and spleen. The father suffered from enlargement of the abdomen, one of his brothers had leucocythæmia, another an enlarged liver, and a cousin an enlarged spleen. The father's mother also suffered from an enormous enlargement of the spleen. We are not told to what extent the family was exposed to malarial influences. In some other instances there has been a history of family ill-health without there being any history of affections allied to leucocythæmia. Thus in a case described by Dr. McCall Anderson, the patient's father had died of some disease of the bowels, the mother of some chest affection, a sister had suffered from a growth, and other members of the family had died young.

Sex.—The influence of sex on the occurrence of leucocythæmia is very distinct. It is twice as frequent in men as in women. Of 153 cases of the primarily splenic form, 100 occurred in males and 53 in females. The mixed lymphadeno-splenic form presents a similar relation to sex. Out of 14 cases 9 occurred in males and 5 in females.

Age.—The influence of age on the occurrence of the disease is also well marked. It may occur at all ages. It has been observed in very young children, even in those at the breast. On the other hand, several cases are on record in which the patients were over seventy years of age. The following table represents the proportion of deaths in 154 cases in the several decades of life. On account of the difficulty, often impossibility, of fixing the date of the commencement of the affection, it has been thought better to compare the ages at which death occurred:—

	Males.	Females.	Total.
Under 10 years . . .	2	2	4
10 to 20 " . . .	11	4	15
20 " 30 " . . .	22	10	32
30 " 40 " . . .	35	11	46
40 " 50 " . . .	16	17	33
50 " 60 " . . .	5	8	13
60 " 70 " . . .	5	1	6
70 " 80 " . . .	5	0	5
Total .	101	53	154

[1] Virchow's Archiv, vol. 20.

[2] Schmidt's Jahrbücher, vol. 155, p. 327; from the Rivista Clinica, 1872.

It thus appears that more than two-thirds of the cases occur between twenty and fifty years (111 out of 154), and that nearly one-third of the total number of cases occur between thirty and forty years of age. The sexes present, however, somewhat different relations to age. Three-quarters of the male cases occur between twenty and fifty, and one-third occur between thirty and forty. Between forty and fifty, the deaths are much fewer than between thirty and forty. In women, the deaths in the child-bearing period of life, from twenty to forty, are equal in each decade, but in the next ten years, that in which the climacteric occurs, they are more frequent than in any other period, and the number of deaths is almost the same in each sex. In the next decade, that between fifty and sixty, there is a great diminution in the number of deaths, and the fall is greater for men than for women; so that during this decade, and during this only, the cases for women are much more numerous than those in men. During the last three decades of life the numbers of males are equal, which, considering the diminution in the number of living, indicates an increasing proclivity in the male sex with advancing years. In women, on the other hand, the disease is almost unknown after sixty years of age, only one case being on record.

Condition of Life.—A comparison of a number of cases shows that the disease occurs with nearly equal frequency in the single and in the married. The female sex affords some exception to this in the relation of the disease to child-bearing, but the effect of pregnancy is not sufficient to render the general rule inaccurate.

It is said that leucocythæmia is much more frequent in the lower than the upper classes; in those who are exposed to privation than in those who live in ease and luxury. The accuracy of the statement is open to grave doubt. A large proportion of the published cases of leucocythæmia have occurred in the poor; but this is chiefly due to the accidental facilities for observation and publication afforded by hospital treatment. The experience of some physicians in large private practice is that the disease is at least as common in the middle and upper middle classes as in hospital patients.

Depressing Physical Conditions.—Intemperance has appeared in a few instances to have predisposed to the occurrence of the affection. These cases are so few, however, only three in 150, that it may be doubted whether it has any real influence.

Inanition is supposed to favor the development of the disease. It is certain that many of the cases presented very ill health for a long period before the occurrence of the symptoms of the disease, and that in some of these the ill health was clearly traceable to extraneous influences, such as deficient food.[1] In several cases depressing emotion appeared to be a predisposing or exciting cause of the affection, and to be followed immediately by symptoms of a cachectic condition which ushered in the pronounced affection. In one case, for instance, severe mental distress, lasting several months, was followed by dyspepsia, and this by a cachexia, in which the abdominal pains, indicative of commencing enlargement of the spleen, supervened.[2] In other instances mental distress has coexisted with some other occasional cause of leucocythæmia, and some share in the effect may be ascribed to both causes. So, in one case, much mental distress followed childbirth, and was succeeded in a little time by great anæmia, and a splenic tumor was soon afterwards discovered.[3]

Over-exertion is said to be an occasional predisposing cause, but its influence is very rarely to be distinctly traced.

Sexual Processes in women appear to have a distinct influence in the production of the malady. In one case the disease was ascribed to an exposure to cold during menstruation. In a considerable number of cases its onset appeared related to pregnancy or parturition; of fifty cases occurring in women such a relation was traceable in eight. The same influence is illustrated by the frequency of the affection during the climacteric decade. It is frequent during the whole of the child-bearing period, thirty out of the fifty cases occurring between twenty and forty-five years of age; but this has less significance since it is most common in men also during the same period. During the climacteric decade, however, nearly a third of the whole number of cases in women occur, and the numbers are more nearly equal than at any other period, while after the climacteric period is over, the disease, in women, is almost unknown. In a few cases the symptoms have come on during pregnancy.[4] More frequently they have succeeded parturition; the weakness after labor has continued as chronic bad health, and in a few months a splenic tumor has been apparent.[5] In one case recorded by Dr.

[1] Simon, Thèse, Obs. iii.

[2] Charcot and Robin, Gaz. Méd. de Paris, 1853, p. 430.

[3] Lissauer, Berl. kl. Wochensch. 1868, p. 40.

[4] Bruzelius, Hygeia, 1872, and Virchow's Jahresbericht. 1873, ii. 299; Feltz, Gaz. Méd. de Strasbourg, 1864.

[5] Barth, Soc. Méd. des Hôp. Nov. 1855;

R. Paterson[1] the progress of the disease after delivery was very acute.

Previous Disease has appeared, in a considerable number of cases, to be related to the occurrence of leucocythæmia, either from the frequency with which it has preceded, at some period, the development of the affection, or from the immediate relation between certain severe illnesses and the occurrence of the hæmic change.

Of these the first place in importance must be given to intermittent fever. Most statistics have assigned a very subordinate position to intermittent fever as a cause of leucocythæmia, although they suggested its occasional influence. But on this point the statistics were somewhat misleading, because, in all, except the small collections of Bennett and Vidal, cases are included of primary disease of the lymphatic glands, in which (as will be shown in the next article) a relation to intermittent is very rarely traced. For the larger statistics, those of Ehrlich have been taken as the basis; and a considerable proportion of Ehrlich's cases are useless for the comparison, because many of the cases collected are too briefly narrated to be of value, and because he included so many cases of lymphadenoma.[2] The cases of splenic leucocythæmia which I have collected show that intermittent fever has, at some period, preceded the development of leucocythæmia in a considerable proportion of the cases. Out of 150 cases there was a distinct history of intermittent in no less than thirty, or one-fifth. But in nine other cases, the patients, although they had never suffered from intermittent, had lived in malarial districts, in which ague was common; and in these a malarial influence may reasonably be assumed to have been at work. This will give thirty-nine cases in which such an influence was to be traced, or more than one-quarter of the total number.

The interval between the occurrence of the intermittent and the development of leucocythæmia varied greatly. In some instances the attack of ague occurred so long before, and was of so slight a character, that doubt might reasonably be felt of its relation to the subsequent disease, if it were not that every gradation can be traced between these cases and those in which severe ague immediately preceded the manifestation of the disease. Of twenty-one cases in which the interval between the last attack and the first manifestation of the disease was definitely ascertained, it was found to present the following variation in years.

30 years	1 case.	7 years	1 case.
25 "	2 cases.	5 "	1 "
22 "	1 case.	4 "	1 "
17 "	1 "	3 "	3 cases.
16 "	1 "	1 year	2 "
12 "	2 cases.	8 months	1 case.
10 "	1 case.	3 "	1 "
8 "	1 "		

The duration of the intermittent also varied. In several cases it was only a few weeks; in others repeated attacks occurred during many years, in one during twenty years. No relation can be traced between the duration of the intermittent and the length of the interval before the occurrence of the symptoms of leucocythæmia. It is remarkable, however, that in some of the cases in which the longest time elapsed before the occurrence of the leucocythæmic affection, the attacks of intermittent, although distinct, were brief. In one case, for instance, a patient suffered from an attack of ague of six weeks duration twenty-two years before the first symptoms of leucocythæmia. In the latter cases and in those in which there had been residence in an ague district, but no distinct attack of intermittent, the malaria must have led to constitutional or splenic changes which ultimately eventuated in the blood disease. Where an interval had elapsed between the two diseases the ague in some cases had left a distinct and persistent enlargement of the spleen.

In a few cases some other acute disease preceded the onset of the leucocythæmia, either immediately, or at an interval during which the patient remained in ill health. In two cases the ill health preceding the splenic change was ascribed to an attack of typhoid fever,[1] one and three years before. In two other cases it was referred to acute rheumatism three and five years previously;[2] in other cases to smallpox[3] and pneumonia.[4] In the latter

Bennett, case xi. case vi., Leudet, Gaz. Méd. de Paris, 1853; Lissauer Berl. kl. Wochenschrift, 1868; Mattei, Gaz. Hebd. 1858, p. 609.

[1] Edin. Med. Journ. June, 1870.

[2] Since Ehrlich's figures have been so extensively quoted and unemployed, it is as well to state that this rejection of his statistics is based on an examination of the details of ninety-eight of his cases (two being inaccessible to me) and the conclusion reached was that of those examined, in twenty-six there was no evidence of any excess of pale corpuscles in the blood, and in some of these it is distinctly stated that there was no excess. Many were cases of primary glandular disease, with simple anæmia.

[1] Bamberger, Würzb. Verhand. 1856; Bouillaud and Duroziez, Gaz. des Hôp. 1858.

[2] Greenhow, Lancet, 1876, ii. 859; Schlepern, Virchow's Jahresb. für 1873, ii. 289.

[3] Patchett, Lancet, 1872.

[4] Biesiadecki, Stricker's Med. Jahrbuch, 1876.

case, however, there was a history of intermittent.

In four cases there was a history of syphilis, but its etiological relation to the leucocythæmia is by no means clear. In one case, however, the patient had a chancre only three years previously, and in the interval had many secondary symptoms.[1]

Injury.—In four cases the first symptoms were ascribed to a blow on the splenic region. In two cases the blow was upon a splenic tumor. In one case a sprain was supposed to be the exciting cause. An instance in which the disease was ascribed with some probability to a traumatic cause is related by Ponfick.[2] A man received a kick from a horse on the left side, and a "stitch" in the side prevented him from working for some time. After an interval of freedom of some months, the pain recurred and again ceased, to return with weakness and some shortness of breath; and later, a year after the blow, a splenic tumor was found, and leucocythæmia, which progressed to death. Post mortem, the enlarged spleen was found universally adherent to the adjacent organs by very dense and firm tracts of tissue, and the adhesion to the diaphragm was continuous with a mass of very hard fibrous tissue which infiltrated the adjacent part of the diaphragm.

PATHOLOGICAL ANATOMY.—*BLOOD.*—The characteristic changes in the blood in leucocythæmia may be observed during life in a drop drawn from the finger, or, after death, in the heart and vessels. The color of the blood is changed; it is paler than normal, and often presents an undue opacity, which contrasts with the clear rose tint of the blood in simple anæmia. When the increase in the number of white corpuscles is very great this change in appearance may be such that the color is grayish red, and it may resemble a mixture of pus and blood. When the change is slight, the coagulation of the blood drawn into a vessel may not be affected: when more considerable, between the ordinary white and red portions of the clot is a layer of softer consistence, composed entirely of white corpuscles, and the red clot is paler and more opaque than usual, and contains many white corpuscles. When the blood-change is extreme, coagulation is imperfect, and a soft grumous mass results, chocolate-brown in tint, often containing white or yellowish points—an appearance which has been likened to that of the softened spleen. The purulent appearance of the blood may be very marked in some clots, as in a case related by Virchow, in which, when the ventricle was opened, an assistant exclaimed, "There is an abscess!" In rare cases clots have been found of a slimy consistence and semitranslucent appearance, resembling certain nasal polypi. If the fibrin is separated from the blood by "whipping," and the defibrinated blood allowed to stand, it separates, as Donné first pointed out, into three layers, the red corpuscles sink rapidly to the bottom, and constitute a lowest red layer; above this is a pale layer consisting of the white corpuscles, and above this is the layer formed by the liquor sanguinis, from which the corpuscles have sunk.

Corpuscles.—In all cases of splenic cachexia the absolute number of corpuscles is lessened. Whether there is or is not leucocythæmia, there is always "anæmia." This diminution in the red corpuscles was long ago insisted upon by Virchow as an integral part of leucocythæmia. The diminution bears no necessary relation to the proportion of white corpuscles. Nevertheless, when an increase in the white corpuscles exists, there is always a considerable deficiency of red, and when there is a very great excess of white there is a correspondingly great deficiency of red; and so by the method of subsidence it is always found that as the layer of pale corpuscles increases the layer of the red diminishes. The number of pale corpuscles is never sufficient to compensate for the deficiency in the red, and so the leucocythæmia is related to an absolute diminution in all the corpuscles of the blood, both red and white. The proportion between the two kinds of corpuscles varies between wide limits. A slight relative increase in the white corpuscles is common, as will be mentioned in the section on pathology, in many diseases besides splenic cachexia, but in them it is usually transient or trifling. In other diseases attended with enlargement of the spleen, more or less closely allied to leucocythæmia, there may be a slight increase in the white corpuscles in the blood. To distinguish leucocythæmia from these various conditions of slighter blood change, Magnus Huss proposed that only those cases should be considered as leucocythæmia in which the proportion of white to red corpuscles exceeds one to twenty. It is hardly necessary to say that this line corresponds to no natural division. Cases of commencing leucocythæmia have been observed in which a splenic tumor was present, and in which ultimately an enormous excess of white corpuscles was present, but in which, when first observed, the proportion of white to red was far less than one to twenty. If this line be adopted, therefore, it must be with the reservation that cases of splenic cachexia are not to be sharply separated from cases of

[1] Mosler, Berk. kl. Wochenschrift, 1864.
[2] Virchow's Archiv, 1876, vol. 67.

pronounced leucocythæmia, merely because the proportion of white to red corpuscles is less than one to twenty. When the disease has made some progress the proportion of white to red is usually much greater than this; the proportion of one to eight or ten is common, and one to three or four almost as common (Fig. 71). Frequently a still greater proportion is observed, one to two, two to three, and sometimes equal numbers of white and red, and in rare cases an actual excess of white. There often appears to be an excess of white, on account of the closer approximation and smaller size of the red corpuscles, when by counting, the latter are found to be far more numerous. But cases are on record in which careful and accurate methods of observation proved the white to be the more numerous. An instance of this is a case mentioned by Sörensen in which the proportion of white to red was ascertained, by counting after Malassez's method, to be as 68 to 47.[1]

It is not easy to ascertain the frequency with which the several degrees of excess are met with. In a large proportion of the cases which are recorded no attempt has been made to ascertain accurately the proportion of the white to the red. Observers have been content to record the fact of the occurrence of an "excess of white corpuscles," or that the white were "increased in number." It is doubtful also how much weight is to be attached to the vague statement that the "white are equal to the red," since an apparent equality may be found on counting to be really a great disparity. Taking, however, the statements as made, in seventy-three cases the proportion has been definitely affirmed, and the following table represents the frequency with which the several degrees of excess were met with:—

1	white	to 20	red	in 3 cases.
1	"	12	"	1 case.
1	"	10	"	1 "
1	"	7	"	3 cases.
1	"	6	"	1 case.
1	"	5	"	7 cases.
1	"	4	"	4 "
1	"	3	"	9 "
1	"	2	"	12 "
2	"	3	"	3 "
White and red equal in				21 "
More white than red in				8 "

It thus appears that of seventy-three cases of splenic leucocythæmia in sixty-four (or 87 per cent.) the proportion of white to red was greater than one to six, and that in fifty-three cases (or 72 per cent.) the proportion was greater than one to four; while in twenty-nine (or about 40 per cent.) the white corpuscles are said to have been as numerous as the red, or more numerous.

In this table only cases of primary splenic enlargement are included. In cases in which the lymphatic glands were first enlarged, the excess is very rarely so considerable. In some cases a primary glandular enlargement has been associated with a change in the spleen similar to that in primary splenic leucocythæmia, and a great excess of white corpuscles has been observed in the blood (lymphadenosplenic form). In the case recorded by Vogel,[1] for instance, glandular enlargement preceded for above two years any splenic symptoms, and the blood presented a proportion of one white to two or three red. But the spleen was very large, and the seat of simple hypertrophy. Several similar cases, all accompanied with a great increase in the splenic pulp, are on record.[2]

There are great difficulties in estimating the relative numbers of white and red in various parts of the vascular system, and hence there is considerable discrepancy in the conclusions of different observers. In one point all agree, that the proportion is greater on the right than on the left side of the heart. Uhle, for example, found the proportion in the right heart 1 to 1·5, when that of the body generally was 1 to 3·5. Most observers have found the proportion greater in the splenic vein than elsewhere. When equal in numbers in the splenic vein, the proportion in the portal vein was found by Uhle to be only 1 to 2 or 2 to 3. De Pury found a proportion of 1 to 19 in the splenic vein, when that in the jugular vein was only 1 to 40. Schmuziger, however, found in one case a smaller proportion in the splenic than in the portal vein. His results gave—

Splenic vein 1 white to 4·1 red.
Portal vein 1 white to 3·4 red.
Right heart 1 white to 2·8 red.
Left heart 1 white to 3·7 red.

The absolute diminution in the number of corpuscles may be as pronounced as is the relative increase of white. It is only of late that more convenient instruments for numeration have enabled the diminution to be determined. The earlier method, that of Welcker, by which the diminution in the coloring power of the blood was taken as the guide to the number of red corpuscles, afforded evidence of the fact of the reduction, although not of its amount, since the method can only be

[1] Virchow's Jahresbericht for 1876, i. 257.

[1] Virchow's Archiv, Bd. iii. 1851.

[2] Wolffhügel, Würzb. Inaug. Abhand., Carlsruhe, 1871; Schmidt's Jahrbuch, vol. 155, p. 330; Rousseau, Thèse, 1874, Case 6; Grisolle and Hémey, Gaz. des Hôpitaux, 1864, p. 161; Schmuziger, Arch. der Heilkunde, 1876, p. 275.

relied on when the corpuscles are of uniform size and possess the normal amount of coloring matter. If the hæmoglobin is diminished in the corpuscles, only a considerable diminution in the coloring power of the blood can be taken as evidence of a diminution in number of the corpuscles. By this method, however, Welcker determined that in one case, in which the white were to the red as 1 to 11, the number of red corpuscles was lessened to just one-half the normal, 2,500,000 per cubic millimetre instead of 5,000,000. In another case, in which the proportion was as 1 to 3, the number of corpuscles was only 2,000,000. More exact observations have lately been made by the method of dilution.[1] In one case of pure splenic leucocythæmia, in which there was one white to five red, the total number of corpuscles was found by Sörensen[2] to be 2,160,000, while in another case of splenolymphatic leucocythæmia, that already mentioned as presenting an absolute excess of white corpuscles, there were only 1,150,000 corpuscles per cubic millimetre (470,000 red to 680,000 white). This is a diminution of the red to one-tenth of the normal and an increase of the white to fifty times the normal, the total number of corpuscles in the blood being rather more than a fifth of the normal.

The white corpuscles are usually, in splenic leucocythæmia, of the normal size, sometimes smaller than normal, occasionally larger. Frequently corpuscles both larger and smaller than normal may be observed in the same case. The larger ones may be two or three times the average size. Usually only one nucleus can be distinguished without the assistance of reagents, and often no distinct nucleus is to be seen. The action of acetic acid brings into view sometimes one nucleus,

[Fig. 71.

Blood in Leucocythæmia. Four of the white corpuscles have been treated with acetic acid. (After Bennett.)]

but more frequently two, three, or four nuclei, or a single nucleus, which presents a horseshoe shape (Fig. 71.) The substance of the corpuscle is usually finely granular, sometimes contains a clear "vacuole," and not unfrequently presents evidence of fatty degeneration; as was noticed first by Bennett.[1] The fat is in the form of strongly refracting granules or minute globules, scattered through the protoplasm, or aggregated in the neighborhood of the nucleus. Commonly, the more numerous the white corpuscles the larger is the proportion which present fatty degeneration. Jaderholm found that in a case in which the white were to the red as 1 to 7, five per cent. of the white corpuscles presented distinct fatty degeneration, while in another case in which the proportion was as 1 to $3\frac{1}{2}$, fifteen per cent. of the white were degenerated. In some cases no degeneration has been seen, although carefully looked for.

The corpuscles of smaller size are most abundant in cases in which the glands are affected, as Virchow pointed out in 1847. Bennett also noted that these smaller corpuscles resemble those found abundantly in the enlarged lymphatic glands. In some cases the blood contains minute bodies resembling the single nuclei of the white corpuscles,[2] and termed by Donné "globulins." In one case on record these were so numerous, that it was estimated that there were eighty globulins to every white corpuscle.[3]

The red corpuscles are usually normal in appearance. Sometimes they are unduly pale, and have, in rare cases, been observed to be smaller than natural.[4] In a few cases corpuscles have been observed nucleated and colored, and these are believed to be intermediate forms between the red and the white cells.[5] Klebs found them in the blood in the dead body, and Neumann found them abundantly in the normal marrow, and very abundantly in the marrow in leucocythæmia. He has also seen them in the blood of leucocythæmia during life, and also in the medulla, in which, however, some other observers have failed to find them.

Chemical Characters.—The reaction of the blood in leucocythæmia has been stated to be acid. Scherer[6] found that the filtrate from the blood from the dead body (treated with boiling water) was acid, and Pettenkofer and Voit[7] also found that the serum was acid after dialysis through parchment, the acidity

[1] The principle of this method, and the details of the modification of it employed by the writer, are described in the section on Diagnosis.

[2] Loc. cit.

[1] Leucocythæmia, p. 23; Drummond, ibid. p. 43.

[2] Bennett, loc. cit. p. 96.

[3] Blache, Bull. de l'Académie de Médecine, Jan. 29, 1856.

[4] Charcot and Vulpian, 1860.

[5] Virchow's Archiv, vol. 38.

[6] Scherer, Virch. Arch. vol. v. p. 64, 1851, and Verhand. der phys. med. Gesell. in Würzburg, 1851, Bd. ii. p. 321.

[7] Zeitschrift für Biologie, vol. v. p. 320.

being due to a volatile acid, for the litmus quickly recovered the blue color on exposure to the air. Schmuziger also found the blood acid after death. Scherer thought that the acidity was characteristic of leucocythæmia, and ascribed it to the presence of formic, acetic, and lactic acids. Gorup-Besanez, however, found that blood which escaped during life was alkaline.[1] The difficulty of understanding that the chemical processes of the body can be carried on with acid blood makes it probable that the acid condition observed after death was the result of post-mortem decomposition.

The specific gravity of the blood is lessened. In health the specific gravity is between 1052 and 1057. In leucocythæmia it varies from 1036 to 1049, the mean being 1042. The diminution in specific gravity depends, of course, on a diminution in the amount of solids, and on a corresponding increase in the amount of water contained in the blood. The proportion of water in health is 790 parts per 1000. In leucocythæmia it is usually more than this. In a case examined by Scherer, the water amounted to 791 parts only, but in most cases it has varied from 815 to 880 parts, the mean being 838 parts.

The fibrin of the blood is usually increased. In health it does not exceed 2½ parts per thousand. In leucocythæmia it is rarely as low as this. Robin found it only 1·4 parts per thousand, but most observers have found it far more abundant, amounting occasionally to 5, 6, and 7 parts per thousand. The latter proportion was met with in one case by Parkes. The average of ten observations recorded by Bennett is 4·8. Some doubt has been expressed regarding these conclusions on the amount of fibrin present in the clot, since many white corpuscles may be entangled in the clot. It may be pointed out, however, that the mode in which fibrin is now known to be formed, by the union of the fibrino-plastin of the corpuscles and the fibrinogen of the serum, renders its increase in this disease an intelligible fact. Isambert and Robin[2] observed that the fibrin has a peculiar granular character. It does not form long elastic filaments on whipping, but falls to the bottom of the vessel in fragments, in which the fibrillar structure is visible only with the microscope. The same condition had been noticed by Bennett.[3]

The fat in the blood was found by Robertson and Isambert to be distinctly increased; in one case to 7·2 per thousand parts.

[1] Virchow's Jahresbericht, 1874, i. 197.
[2] L'Union Méd. 1867, 307.
[3] Loc. cit. p. 11.

The amount of iron is diminished. The normal amount has been very variously stated from ·4 (Becquerel) to ·9 (Jarish) parts per thousand. Strecker[1] found, however, only ·34 of oxide of iron, and Scherer ·29 parts of pure iron per thousand.[2] In the blood analyzed by Strecker, the white corpuscles were stated to be one-half or one-third as numerous as the colored ones. In a case in which the corpuscles were as 1 to 3 or 4 (post-mortem), the iron was found by Schmuziger to amount to ·297 parts per thousand.

The albumen in leucocytic blood is said to be diminished, but the statement rests on one analysis only, and very few attempts have been made to ascertain its amount. It was found by Becquerel[3] to amount to 75 parts per thousand of serum, the other constituents being 907 parts of water, and extractive saline and fatty matter 16 parts.

Various substances have been found in the blood in this disease, which are not present in normal blood, or in the blood of persons with simple anæmia (Sée), at least in quantities which can be detected. Some of these have also been found in the spleen.

Reichardt[4] has described a substance in the blood analogous to that found by Thiere to result from the action of potash on albumin and vitellin, and which was termed albukalin. The formula for it is $C_8H_6N_2O_6 + H_2O$, nearly the same as glycocoll.

Mucin, or a substance closely allied to it, has been found by Scherer, Reichardt, Schmuziger, and others.

A body closely analogous to glutin, has been found by several observers (Mosler, Salkowski,[5] Gorup-Besanez). It differs from glutin in having no action in polarizing light, and also in not yielding glycocoll when boiled with sulphuric acid. Salomon failed to find glutin itself.[6]

Hypoxanthin, which is found in the spleen in leucocythæmia, was found in the blood by Scherer, and his observation has been abundantly, though not invariably confirmed.[7] Andrae[8] and Ossikowsky found traces of xanthin, but Gorup-Besanez sought for traces of xanthin without success. Kreatin was found by Ossikowsky.

[1] In Vogel's Case, 1851.
[2] Würzb. Verhand. 1851.
[3] Gaz. des Hôp. 1856.
[4] Jenaische Zeitschrift für Med. 1870.
[5] Virchow's Archiv, Bd. 50.
[6] Reichert's Archiv, 1876, Heft vi. p. 762.
[7] Hypoxanthin has been found by Mosler, Reichardt, Salkowski, Ossikovsky, Gorup-Besanez, and Salomon. It was not found by Andræ or Folwarckny.
[8] Deut. Zeitschrift für prakt. Med. 1875.

Leucin has been said to be present, but Gorup-Besanez failed to find it. Tyrosin was found by Folwarczny.

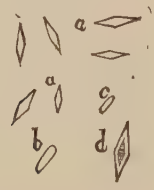
Uric acid was found in the blood by Scherer and Mosler, but could not be detected by Parkes or by Folwarczny.[1]

Acetic, lactic, and formic acids are said to have been found in the blood; and the occurrence of the two latter, which are found also in the spleen, has been well confirmed. They have been found in the blood during life,[2] as well as in the dead body. Acetic acid has been found only after death.

An organic substance containing phosphorus was found in the blood after death by Salkowski, and was conjectured to be a glycerin-phosphoric acid.

Crystals.—Peculiar crystals have been found in the tissues of the subjects of this disease after death. The first published observations of their occurrence was in a case recorded by Charcot and Robin in 1853,[3] the microscopical observation having been made by Robin. Zenker[4] has lately stated that he observed them in three cases before Robin's observation was published. In 1855 they were found in the blood, in all parts, by Mr. Jas. Wallace, of Glasgow.[5] They were found in the blood and liver, and carefully studied, by Charcot and Vulpian in 1860.[6] They are elongated octohedra (Fig. 72),

Fig. 72.



Blood crystals (after Zenker). *a*, *d*, regular octohedra; *b* *c*, with the angles rounded.

colorless, very minute, in average length about ·016 mm., and ·005 mm. in width. Some have been observed larger than this, ·04 mm. in length, and ·008 mm. in width.[7] They always present similar chemical characters, being insoluble in cold water, alcohol, ether, or glycerine, soluble in hot water, and in most acids and alkalies. Their nature is uncertain: it has been conjectured that they are composed of a crystallizable organic substance, an albuminate (Charcot) or a mucin-like substance (Salkowski). The crystals have only been found after death, and hence it is assumed that the substance of which they consist is held in solution during life, and only crystallizes out after death. Their appearance, post-mortem, may be due partly to the lowered temperature of the body. Charcot and Vulpian found that they disappeared if the blood was warmed to 60° C. or 70° C., and re-formed a few hours after cooling. The number of crystals is said to increase the longer the time that has elapsed after death. They are not found in healthy blood, and hence it is assumed that either the substance is absent, or that it is held in some combination which prevents it from crystallizing. They have, however, been found in healthy marrow by Neumann.

In leucocythæmia they are found most constantly in the spleen; they have been found in the blood frequently; also in the glands, the marrow, the liver, the spinal cord, and the thymus gland (Desnos). They are most abundant in the spleen, and their occurrence in the blood may be associated with the presence in it of some of the peculiar constituents of the splenic pulp. In the blood they have been seen within the white blood corpuscles, and hence the substance has been supposed to be contained in these corpuscles. The circumstance, however, may also be due to the habit of the white corpuscles of taking small particles into their interior.

They are not peculiar to leucocythæmia; they have been found in the portal blood in a case of simple anæmia, and also in the expectoration in cases of bronchial asthma (Charcot, Friedreich, Leyden). Their presence in sputum has been accounted for by supposing that the substance is contained within the white blood corpuscles, and passes out with them.

ORGANS— *Spleen.* — Enlargement of the spleen is characteristic of splenic leucocythæmia. The degree of enlargement is usually considerable, often extreme. The organ varies in adults under normal conditions from 4 to 10 oz. in weight. The average may be taken as about 5½ oz. (150 grammes, Birch-Hirschfeld[1]). Its average normal dimensions are 4½ or 5 inches in length, 2½ or 3 inches in width, and about 1¼ inches in thickness. The spleen in leucocythæmia has been found to weigh from 10 oz. (in a child) and 12 oz. (in an adult), twice the normal weight, to 16 or 18 lb., or more than fifty times the normal weight.

[1] Zeitschrift der Wiener Aerzte, 1858, No. 32.

[2] Both by Folwarczny and Körner; formic only by Gorup-Besanez and Reichardt.

[3] Comptes Rendues de la Soc. de Biologie, vol. v. 1853, p. 44.

[4] Deut. Archiv für Klin. Med. vol. xviii. 1876, p. 125.

[5] Glasgow Med. Journal, April, 1855.

[6] Gazette Hebd. 1860, p. 756.

[7] Charcot and Vulpian, Neumann.

[1] Deutsche Zeitschrift für prakt. Med. 1874, p. 40.

The greatest weights recorded are 18½ lb. (Langley Browne),[1] 16½ lb. (Sizer),[2] 15½ lb. (Mosler),[3] and 14 lb. 15 oz., after the escape of two litres of blood (Koeberlé). It is rare, however that the size of the spleen is so great. The following table presents the weight of the organ in 72 cases.

	No. of cases.		No. of cases.
Under 1 lb.	2	8 to 9 lbs.	1
1 to 2 "	5	9 " 10 "	4
2 " 3 "	5	10 " 11 "	2
3 " 4 "	12	12 " 13 "	2
4 " 5 "	9	14 " 15 "	1
5 " 6 "	11	15 " 16 "	1
6 " 7 "	7	16 " 17 "	1
7 " 8 "	8	18½ lb.	1

The average weight of the seventy-two cases is a little under six pounds (5 lb. 14 oz., about 2500 grammes).

The size of the spleen undergoes a corresponding increase. The organ usually enlarges in all directions, so that the normal proportions are preserved, *e. g.*, a spleen weighing 198 oz. measured 18 × 10 × 6 inches. Occasionally it enlarges more in one direction than another, and thus may become long and narrow, as one which weighed 64 oz. and measured 12 inches long by 4 wide. It varies from 6 to 18 inches in length, from 4 to 10 inches in width, and from 2 to 6 in thickness.

The following table shows the length of the spleen in a series of fifty-six cases. The variations in width and thickness prevent the length being a very close guide to the actual size of the organ, but it is of importance as the most significant dimension which can be determined by physical examination during life:—

Length 6 to 7 inches	in 3 cases.
" 7 " 8	" 2 "
" 8 " 9	" 4 "
" 9 " 10	" 7 "
" 10 " 11	" 7 "
" 11 " 12	" 9 "
" 13 " 14	" 10 "
" 14 " 15	" 6 "
" 15 " 16	" 3 "
" 16 " 17	" 1 case.
" 17 " 18	" 3 cases.
" 18 " 19	" 1 case.

The average length of the whole series is 11¼ inches.

The organ when much enlarged occupies, of course, a large portion of the abdominal cavity. It is sometimes free from adhesions, but more frequently is connected with the diaphragm, abdominal wall, omentum, intestines, and left lobe of the liver. The enlargement is commonly uniform, and the general outline of the organ is preserved, the indentations on the inner border being usually exaggerated, and almost always distinct. The surface is smooth, but often presents the evidences of local peritonitic changes—rarely recent rough lymph, more commonly white or yellowish opaque patches, about a line in thickness, and semicartilaginous in consistence. The color of the unchanged portions is usually dark bluish purple.

The consistence of the spleen is sometimes normal, rarely diminished, often increased. The cut surface is smooth, even shining, and yields little blood compared with a normal spleen. Virchow pointed out that the larger the spleen and the longer the duration of the case, the firmer is the organ and the less the relative amount of blood in it. In the early stage the organ may be soft and contain much blood. The tint of the cut surface is usually grayish or brownish red, sometimes, in old cases, flesh-colored or pale brown, or even brownish yellow. Its aspect is, to the naked eye, commonly uniform, sometimes marbled by whitish lines, due to thickened trabeculæ, or less vascular lymphoid tissue. The Malpighian follicles are seldom conspicuous; usually they are not to be distinguished. They are often visible in the early stage of the enlargement, recognizable by their paler tint, but are usually only slightly enlarged, and often not of larger size than that which they may present under normal conditions. Occasionally they are distinctly enlarged, but they are less sharply defined. It is evident that the increase in the size of the organ is due to a growth of tissue corresponding in position to the splenic pulp.

In rare cases, however, the Malpighian follicles do enlarge, become conspicuous, and constitute what are practically small growths scattered through the organ. These cases are for the most part those in which the disease commenced as a primary lymphatic gland affection, or as a simultaneous enlargement of glands and spleen. In the primarily splenic leucocythæmia such scattered follicular growths, differentiated from the splenic pulp, are almost unknown.

The spleen rarely presents softening. In one case a small collection of pus was found in the organ,[1] and in another the upper half of an indurated spleen contained a small focus of softening, while the lower half was converted into a vast pouch filled with a soft material, consist-

[1] Lancet, 1877, vol. ii. p. 310. The spleen was excised. The degree of increase in the white corpuscles is not described in the account of the case, but Mr. Langley Browne has informed me that they appeared more numerous than the red, in the blood which was examined during life.

[2] Gaz. Hebd. 1873, No. 48.

[3] Berl. Kl. Wochenschrift, 1864, p. 140.

[1] Virchow's Archiv, v. 59.

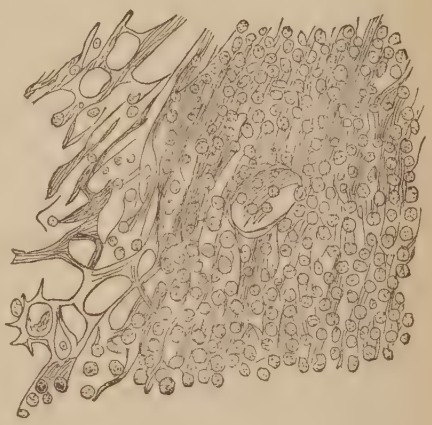
ing of *débris* of splenic tissue and coloring matter derived from the blood.[1]

In many cases the spleen presents areas of darker or paler color than the rest of the organ. They may be dark-red, like extravasated blood,[2] or reddish-yellow, or yellowish-white and caseous. These are situated near the surface, and are more or less wedge-shape in form. Some of them are surrounded by a zone of hyperæmia. They resemble precisely (as Dr. King Chambers first pointed out) the change often seen in cases of heart disease, and now known to be the result of embolic infarction; and their origin, from a similar process of vascular obstruction, has been traced in the leucocythæmic organ by Bourdon. The arteries of the spleen are "terminal," *i. e.*, have no anastomoses. These hemorrhagic and degenerated areas may sometimes be due to thrombosis in the splenic veins. They have been met with in an enlarged spleen associated with simple anæmia.[3] There may be only one or two such areas, or they may be very numerous. In one case eighteen separate infarctions were observed.[4]

Microscopical examination shows that the process of change consists, in most cases, in a simple increase of tissue elements similar to those which exist in the normal splenic pulp. A scraping of the cut surface presents, under the microscope, a large number of red blood globules, leucocyte-like corpuscles various in size and in the character of their nuclei and contents, spindle cells from the trabeculæ, large cells, oval or round, $\frac{1}{200}$ inch in diameter, containing several nuclei, and sometimes giant cells filled with small corpuscles $\frac{1}{300}$ to $\frac{1}{1500}$ inch in diameter (Drummond). There is also much pigment, black, red, and yellow.

On examination of hardened sections a great increase in the trabecular tissue is seen, the finer tracts of which are connected with a network of connective tissue cells closely connected, and passing on the one hand into connective tissue of the trabeculæ, and on the other into a fine retiform tissue of nucleated fibres or films. In the meshes of this tissue lie great numbers of lymphoid cells. The connective network furnishes the numerous spindle cells seen in a scraping. The Malpighian bodies, however, are less distinct. In some cases they have appeared atrophied, in others they are indistinguishable from the rest of the tissue. They have been observed to undergo retrogressive changes, fatty and lardaceous.[1] In the latter case I have found that the degeneration involves equally the periarterial lymphoid tissue of which the Malpighian bodies are but local collections. This periarterial tissue may often be seen to be

Fig. 73.



Section of spleen in leucocythæmia showing lymphoid cells lying in an irregular stroma, from which, on the left, the cells have been removed by pencilling.

thickened, and Biesiadecki has asserted that an outgrowth from this into the splenic pulp is the essential process. It is certain that the structure of the splenic pulp becomes far more similar to the lymphatic tissue around the arteries and of the follicles than it is in health. But the fact that when there is a great increase in the tissue of the pulp, the follicular and periarterial tissue may remain distinct, is reason for believing that the pulp growth is not due to the extension into it of this tissue.

The infarct-like masses present the same histological elements as the spleen. When opaque, the cells within them present fatty degeneration, and are mingled with "compound granular corpuscles," round or oval bodies containing granules and globules of fat. Sometimes only fat cells and the more resistant spindle cells of the splenic trabeculæ are to be distinguished.

In many cases the crystals already described have been found in the spleen. In one case Deiters found them so abundant that on a scraping of the splenic pulp being placed under the microscope, a dozen were visible in every field.

Crystals of cholesterin were found in one case by Goupil. They were arranged in granular masses, visible to the naked eye.[2] On chemical analysis the splenic tissue has been found to contain glutin,

[1] Cuffer, Bull. de la Soc. Anatomique, 1876, p. 195.

[2] Bennett, p. 24.

[3] Müller, Berlin klin. Wochenschrift, 1867.

[4] Bryant, Guy's Hosp. Reports, 1866, p. 444.

[1] Böttcher, Thierfelder, and Uhle.

[2] Goupil, Soc. Méd. des Hôp. 1858, Nov.

glycocoll, hypoxanthin, xanthin, leucin, and tyrosin, but no uric acid.

Supernumerary spleens, "splenicula," always present the same changes as the spleen itself. The spleen has been found ruptured in leucocythæmia, the accident having been apparently spontaneous.[1]

Lymphatic Glands.—In splenic leucocythæmia the lymphatic glands are enlarged in one-third of the cases. Out of 157 cases, enlargement of the glands, few or many, was found after death or observed during life in fifty-one. (From this number all those cases in which the gland enlargement was an initial symptom have been excluded.) The glands in the abdominal cavity were most frequently affected (in thirty-nine cases), those in the thoracic cavity least frequently (in eleven cases). The several groups of glands are affected in the following order of frequency :—

Mesenteric . . .	29 cases.
Cervical	24 "
Inguinal	24 "
Axillary	21 "
Retro-peritoneal . .	18 "
Thoracic	11 "
Portal	5 "
Iliac	3 "

The affection of the glands was universal in only five cases. The frequent enlargement of the mesenteric glands is independent of the affection of the intestinal follicles, which may be normal when the mesentery is so changed by the general enlargement of the glands that it stands up from its attachment and is three fingers' breadth in thickness.[2]

The degree of the enlargement of the glands is not often considerable. The individual glands scarcely ever exceed, and rarely reach, the size of a walnut. In this respect a marked contrast is presented to those conditions of lymphatic disease in which the enlargement of the glands is an initial symptom. The glands are usually soft, sometimes very soft, occasionally firm, especially when the enlargement is slight. The surface is smooth and usually free from undue connection with adjacent structures. On section they are gray or reddish-white, frequently mottled red from vessels. A distinction between cortex and medulla is often preserved. Sometimes there are numerous hemorrhages into the substance, especially when the enlargement is rapid, the glands soft, and the tendency to hemorrhage considerable. Sometimes caseation is met with in some of the glands,[3] but it is never general or even abundant. Very rarely, some of the glands may suppurate. In one case of well marked leucocythæmia with a very large spleen, the cervical glands enlarged and suppurated a month before death.

Under the microscope the glands present an appearance which differs but little from the normal structure. An adenoid reticulum can be seen in brushed sections, and in the meshes of this lie great numbers of lymphoid corpuscles. There is rarely that increase in the reticulum which is met with in lymphadenoma. Crystals resembling those met with in the blood and the spleen have been found in one case in the mesenteric glands (Lauenstein).

Alimentary Canal.—The gums sometimes present uniform swelling, and occasionally ulceration, which may be gangrenous in character. The swelling has been found in some cases to be due to a diffused lymphoid growth in the substance of the gum; in others, the only recognized change has been a dense infiltration of the tissue of the gum with leucocytes.

The lymphatic follicles at the base of the tongue, and the tonsils, are the seat of growths of lymphoid tissue occasionally, but far less frequently in primary splenic leucocythæmia than in the various forms of lymphadenoma, and the cases in which they occur are marked by considerable enlargement of the lymphatic glands; as, for instance, one recorded by von Recklinghausen.[1] In the same case there were soft nodules on the posterior surface of the epiglottis, and, in great numbers, in the mucous membrane of the larynx and trachea; some of these were ulcerated.

The mucous membrane of the stomach may be congested, and its cavity may contain blood, without any breach of surface being visible. The collections of lymphoid tissue which lie between the tubular glands may be enlarged, and visible as whitish granulations in the substance of the mucous membrane. Overgrowth of the solitary glands may cause them to project conspicuously from the surface of the mucous membrane. The affection of these follicles is, however, much less frequent than that of the intestinal glands, and never so considerable as is occasionally seen in Hodgkin's disease.

Ulcers have been found in the duodenum in two cases :[2] their nature is not clear. In neither case was there any affection of the rest of the intestine. In the other parts of the small intestine, jejunum and ileum, the solitary and Peyerian follicles are frequently enlarged, paler

[1] Seitz, Deutsche Klinik, 1866.
[2] Simon, Thèse, Obs. i.
[3] Cuffer, Bull. de la Soc. Anatomique, 1876, p. 195; Reincke, Virch. Archiv, Bd. 50.

[1] Virchow's Archiv, vol. 30, 1864, p. 370.
[2] Von Franque, Deutsche Klinik, 1856, p. 462. Mattei, quoted in Gaz. Hebd. 1858, p. 609.

than natural, and more prominent. In one case they were described as "thick and fleshy."[1] Rarely, the solitary glands are enlarged, while Peyer's patches are not.[2] Occasionally the lymphoid growth extends beyond the limits of the follicles, and infiltrates, locally, the submucous tissue. Such a growth was found very abundantly in one case by Ollivier and Ranvier; it formed a series of prominences about the size of a pea flattened in the centre, and with the microscope an abundant nucleated retiform tissue, containing round corpuscles, was seen. Similar growths were pigmented in another case, in which they attained a large size, from a pea to a walnut, and existed chiefly in the jejunum.[3] Occasionally one or more masses of growth of still larger size are met with.

These lymphoid growths in the intestine frequently ulcerate. The ulcers have their edges thickened by a similar lymphoid growth, and bear considerable resemblance to tubercular ulcers, for which they were formerly sometimes mistaken. In one case, in which there was a sago spleen, a similar lardaceous degeneration of the openings of the gland ducts in the small intestine was found by Böttcher.[4]

In the large intestine changes are occasionally found similar to those which have been described as occurring in the ileum. The mucous membrane may be softened or congested. There may be submucous extravasations or superficial ulcers. Occasionally, as in the stomach, blood is effused without any recognizable breach of surface. The solitary glands may be enlarged, with or without enlargement of those in the small intestine. They usually become less conspicuous towards the lower part of the bowel. In one case, recorded by Dr. Wickham Legg,[5] there was an immense overgrowth of the solitary glands in the colon, some being as large as filberts. They were surrounded by a zone of redness, and were small in the sigmoid flexure, and inconspicuous in the rectum. These growths are frequently ulcerated, and sometimes the ulceration has the appearance of having been of old standing, and is deep.[6] Occasionally ulcers, apparently unconnected with the lymphatic growth, may be found in the colon.[7] The degree of glandular overgrowth in the intestine presents no regularity when it occurs. The colon may be greatly affected alone, or in conjunction with faucial glands, when the stomach and small intestine are healthy.[1] The vessels in all parts of the intestine may be found filled with white blood corpuscles.

Peritoneum.—In rare cases the surface of the peritoneum has been found to be covered with minute growths, sometimes resembling tubercular granulations in appearance and size, and even regarded as such; sometimes larger and evidently lymphoid in character. Such growths occurred on the peritoneal surface of the intestine in three cases; in one case they attained the size of cherries on the colon, and in one they were pedunculated. Hemorrhage into the peritoneal cavity occasionally takes place, and when not fatal by the anæmia it causes, the blood usually sets up peritonitis. The source of the hemorrhage has been various. In one case it was the rupture of some vascular adhesions of the spleen; in another it was a puncture to let out ascitic fluid. In one case a large extravasation occurred in the retro-peritoneal connective tissue.[2]

Liver.—The liver is frequently diseased in leucocythæmia. Out of 109 cases in which the state of the liver was noted, during life or after death, it presented some abnormal condition in eighty-seven. But in twelve other cases a post-mortem examination was made, and any abnormal appearance would probably have been mentioned. A morbid state was thus mentioned in 87 out of 121 cases. It seems therefore correct to state that the liver is abnormal in at least two-thirds of the cases of splenic leucocythæmia.

The size of the liver varies. In three cases only was it below the normal, and in these the organ was the seat of cirrhosis, a complication probably accidental. In the remainder, the organ was enlarged. The degree of enlargement varied from a little above the normal to four times the normal. The following table represents the weight of the organ in thirty-six cases in which this was noted:—

Between	4	and	5	lbs.	in 3 cases.
"	5	"	6	"	6 "
"	6	"	7	"	11 "
"	7	"	8	"	4 "
"	8	"	9	"	8 "
"	9	"	10	"	1 case.
"	10	"	11	"	1 "
"	12	"	13	"	1 "
"	13	"	14	"	1 "

The heaviest weight recorded is 13¾ lb.[3] The average of the thirty-six cases is a little over 7 lb. (115 oz.; 3260 grammes).

[1] Benson, Dubl. Journal, 1872.

[2] Craigie; Desnos, L'Union Méd. 1868; Neumann, Arch. d. Heilk. vol. xi.

[3] Lauenstein, Deut. Arch. f. kl. Med. 1876, Bd. 18.

[4] Virchow's Arch. Bd. 37, 1869, p. 163.

[5] St. Barth. Hosp. Rep. vol. xi. p. 68.

[6] Wilks, Guy's Hosp. Rep. 1855, p. 361.

[7] Reincke, Virchow's Archiv, 1870, Bd. 50, p. 339.

[1] Wickham Legg, loc. cit.; Ollivier and Ranvier, Arch. de Physiologie, 1869, p. 416.

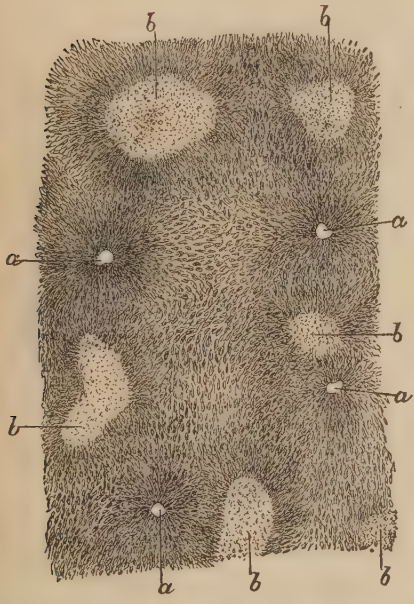
[2] Gairdner, Case xii. in Bennett's "Leucocythæmia."

[3] Walshe, Case viii. ibid.

In the majority of cases of enlargement (fifty-four out of eighty-seven) no morbid appearance was observed. It would probably be incorrect to assume that the liver in all these cases was healthy: since we know that the most frequent morbid change in leucocythæmia may elude ordinary observation, and some of the cases were recorded before the minute changes in the liver were generally known. But in many cases of leucocythæmia the liver, even when considerably enlarged, has appeared to skilful examiners to be normal in structure. Virchow has asserted that such enlargement is due to hypertrophy of the liver cells, by which the acini are increased in size. As examples of the size which the liver attained without visible alteration in structure may be mentioned—5¾ lb. (Vogel), 6 lb. (Page), 6½ lb. (Kœberlé), 6¾ lb. (Da Costa), and 8¼ lb. (Barclay).

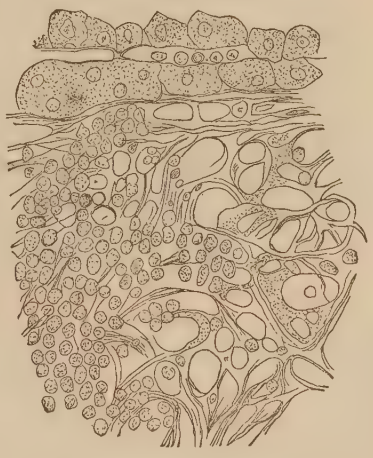
The next most frequent change is the existence of minute points or nodules of new growth in the liver. These were found only in thirteen cases, but probably existed in a much larger number, since they can often only be distinguished by the microscopical examination of sections of the hardened organ. With these disseminated growths there is frequently associated a great distension of the capillaries by blood loaded with leucocytes, and this congestion of the liver may be the only recognizable morbid change. It was so in seven cases. The size which the liver may attain may be, in each of these conditions, considerable. In cases of disseminated growths, weights of 6¼ lb. (De Pury), 8 lb. (Patchett, von Franque), 8¼ lb. (Mosler), and 12¼ lb. (Bennett), are recorded; while instances described as congestion have been met with in which the organ weighed 7 lb. (Gordon Jack-

Fig. 74.



New growths in the liver in splenic leucocythæmia, showing their interlobular position. *a a* branches of hepatic vein occupying the centres of the acini. *b b* nodules of new growth between the acini.

Fig. 75.



New growth in the liver in splenic leucocythæmia. The lymphoid cells have been removed from part of the section by pencilling, so as to show the stroma in which they lie. Above are seen some of the hepatic cells.

son), 7¼ lb. (Ollivier), 8½ lb. (Reincke, Bryant), and 13¾ lb. (Walshe).

The growths in their most common form present the appearance of minute grayish-white granules, the size of ordinary tubercles or larger. The smaller are more or less rounded in form; the larger commonly irregular, according to the conditions of origin and growth. They may be apparently isolated, and then are commonly situated between the acini of the liver (Fig. 74), or may lie adjacent to vessels, chiefly to branches of the portal vein, and extend along it, sometimes filling up a branch of a portal canal (Fig. 76). They may invade the substance of the acini by extending between the columns of liver cells; less commonly they compress the liver tissue, and may thus become surrounded by a pseudo-capsule of compressed liver-cells. They consist of lymphoid cells lying in the

meshes of a nucleated stroma of fibres and films, which can be brought into view by pencilling a section (Fig. 75). The number of leucocyte-like cells they contain, and their position adjacent to vessels, have given rise to the opinion that they arise from emigrated leucocytes, and even that they consist only of extravasated corpuscles. But the presence of a distinct stroma certainly quite different from the coarse laminar stroma in the meshes of which the liver-cells lie, shows that there is something more than extravasation, that there is an actual growth. In support of the view of the local origin of these lymphoid cells is the observation of Cohnheim, in which similar growths were found in the liver in a case of simple enlargement of the spleen without any increase in the white corpuscles of the blood.

The congestion, which is occasionally so marked, consists in the distension of the capillaries with white corpuscles. This may take place in the substance of the acini, so that the rows of liver-cells are separated by masses of white corpuscles contained in capillaries, the walls of which may not be at first visible (Fig. 76). In the interacinal spaces dense accumulations of corpuscles take place, sometimes having the character of a lymphoid growth, pressing on the outer cells of the acinus, causing their atrophy, and sometimes invading the acinus itself, reaching even the centre. These tracts may be visible as whitish ramifications separating the acini. In the substance of the lobule the cells, according to Ranvier, are contained within enormously distended capillaries, but Waldeyer[1] believes that they lie outside the capillary vessels and com-

Fig. 76.

Section of the liver in leucocythæmia, showing infiltration of portal canal. *a a* acini of the liver. *b* branch of portal vein lying in the middle of the portal canal. Above its bifurcation is seen the section of a bile duct. *c c* lymphoid growth filling up the portal canal, and at *d* invading the tissue of an acinus. *e* separate centre of growth between two acini. *f* section of branch of hepatic vein in centre of lobule divided longitudinally.

press them, as well as the hepatic cells. He believes that even the apparent congestion is really a growth commencing in the connective tissue, in the interstices of which, as von Recklinghausen has shown, the minute lymphatic vessels commence. The lymphoid cells, according to Waldeyer, multiply by division, and enter and distend the minute capillary vessels.

Another frequent change in leucocythæmia is fatty degeneration of the liver-cells. It was conspicuous in ten cases. It is no doubt due in part to the defective supply of oxygen, from deficiency in the number of the red corpuscles, as in simple anæmia. Several of the instances of extreme enlargement of the liver were due to this cause, as, for instance, those in which the organ attained the weight of 9¼ lb. (Siering) and 10½ lb. (Boullaud and Duroziez).

Kidneys.—The kidneys in splenic leucocythæmia may be healthy, or may present parenchymatous or interstitial changes. Out of 111 records of post-mortem examinations in this disease, the state of the kidneys is mentioned in 62, and in 12 of these they are described as normal, in 50 as abnormal. It may therefore be assumed that in at least one-half of the cases of splenic leucocythæmia these organs present some abnormal appearance. The most common changes are, simple pallor; simple enlargement; enlargement with pallor; interstitial accumulation of lymphoid cells, diffused or aggregated into definite foci which have the character of distinct lymphoid growths; fatty degeneration; extravasations of blood in the pelvis; interstitial

[1] Virchow's Archiv, Bd. 35, 1866, p. 214.

deposits of uric acid and actual calculi; and lastly, changes indicative of actual "Bright's disease" of various kinds.

In eight cases undue pallor was the only morbid change noted. The exact cause of the pallor has not, in any case, been investigated; but it is probably to be ascribed in part to the blood changes, the deficiency of red and the excess of white corpuscles in the vessels, and in part to undue opacity of the kidney cells. In one of these cases albumen was present in the urine.

In five cases the kidneys were not only pale but large. In one instance the two together weighed 12 ozs., in another 16½ ozs., and in this case they were "mottled." Externally these large pale kidneys are smooth, and the increased size is found, on section, to depend mainly on an increase in the thickness of the cortex. It is probably due partly to distension of capillaries with leucocytic blood, and partly to increased size of the cells of the organ. Albuminuria may be present or absent in these cases. It was absent in the case in which the two kidneys weighed 12 ozs., and is not mentioned in the case in which the two weighed 16 ozs. When albumen has been present in the urine its quantity has been small, and no casts have been found. In three cases the kidneys were large, owing to an increase in the thickness of the cortex, without being pale.

In many cases the cortex presents white points and lines lying between the tubules. In some, these are most conspicuous in its outer layer. On microscopical examination they are found to depend upon accumulations of lymphoid cells between the tubules. The latter may be separated widely, and their epithelium may undergo degeneration in consequence of the pressure to which they are exposed. According to Ollivier and Ranvier, although these cells apparently lie in the interstitial tissue, they are really contained within greatly dilated capillaries. Virchow and Waldeyer, on the other hand, maintain that they are outside the capillaries in the interstitial tissue, where they are formed by nuclear proliferation, and that they are really lymphatic growths and resemble those of the liver. Virchow pointed out that the accumulations are found within the Malpighian bodies as well as in the interstitial tissues. These cells may undergo fatty degeneration, and minute foci of suppuration may result.[1]

Whether these minute accumulations of cells are growths or not, there occur, in many cases, aggregations of lymphoid cells which have all the characters of lymphoid growths. They may be small, resembling gray granulations in size, or may attain the diameter of a quarter of an inch. Such distinct growths were described in ten cases. They are grayish-white in color, rounded, and sharply limited from the adjacent kidney substance. They are usually most abundant in, and often confined to the cortex, and sometimes appear to arise in the neighborhood of the glomeruli. On the surface, the position of the larger is usually marked by a prominence beneath the capsule, sometimes, when there is parenchymatous swelling of the organ, by a depression. The growths, when small, bear, as in the liver, considerable resemblance to miliary tubercle, and were described as such by some of the earlier observers. Under the microscope they consist of lymphoid corpuscles massed together, and on the removal of these a retiform stroma may commonly be found. The kidneys in which these growths occur may be normal in size, but are more commonly enlarged, sometimes to a considerable degree. In one case the two kidneys weighed together 13¼ ozs. The enlargement depends, however, only to a slight extent on the growths. It is due in chief part to the parenchymatous swelling of the organ and capillary distension, which often coexist.

Pronounced fatty degeneration was the conspicuous morbid appearance of the kidney in a few cases. It is probably, when not due to accidental causes, to be ascribed to the anæmia, and is to be regarded as a further stage of the pale enlargement which is so frequent.

In several cases there were accumulations of uric acid between the tubules of the kidney. It will be seen that there is, in this disease, an excess of uric acid present in the blood, and it is not therefore surprising that it should be deposited in the excretory organ. In two cases renal calculi were present. In several cases in which a hemorrhagic tendency existed, extravasations were found beneath the lining membrane of the pelvis of the kidney.

Some of the changes above described, if they progressed further, would give rise to a condition which might merit the name of Bright's disease. Actual Bright's disease was present in six cases, but would appear, in most of these, to have been due to extraneous cases, and must therefore be regarded as a complication of the disease, and as such it will be described.

The supra-renal bodies have been found diseased in three cases of leucocythæmia. In two they were enlarged and softened: in one[1] they were the seat of caseous change, the result, it was believed, of the

[1] Ollivier and Ranvier, Gaz. Méd. de Paris, 1867, p. 365, and Arch. de Physiologie, 1869, p. 416.

[1] Vogel, Virchow's Arch. Bd. 3, p. 570.

degeneration of extravasated blood. In one case[1] in which the organs were large and mottled, there was some bronzing of the skin.

The thymus gland has been found enlarged in several cases,[2] in one considerably. Its enlargement appeared to be due to a lymphoid growth. The affection is not so considerable or so frequent as in cases of Hodgkin's disease. In one case it was found to contain crystals, such as occur in the spleen and blood. The *thyroid* gland is also occasionally enlarged; it was so in five cases.[3] In one case the left lobe was large and soft, and contained a quantity of semi-purulent fluid.

Heart.—Effusion into the pericardial sac is common. The quantity of fluid is not great, and there are usually no signs of pericarditis. The effusion is part of a universal œdema. In the rare cases in which traces of pericarditis have been found, it has usually been distinctly due to an intercurrent malady, as in one case to variola. The effusion presents the normal characters, being rarely, if ever, hemorrhagic. Hypoxanthin has been found in it in one case by Salomon. Growths on the visceral layer of the pericardium were found by Wolffhügel, isolated and conglomerate masses, the size of peas, consisting, under the microscope, of roundish granular cells the size of white corpuscles.

In several cases extravasations of blood were found beneath the pericardium on the surface of the heart. By the degeneration of the effused blood they may leave pale slightly prominent patches, and similar spots have been observed on the trabeculæ of the left ventricle, and even in the substance of the wall. The capillaries of the heart have been noticed to be crammed with white corpuscles, accumulations of which may exist between the fibres. In one case the lymphatic vessels on the surface of the heart were unduly conspicuous.[4] The muscular fibres have been found, in several cases, to present granular and even fatty degeneration, as in other forms of intense anæmia. The fibres of the heart have, however, been found healthy, even when the white corpuscles were more numerous than the red, and the capillaries of the heart appeared full of them. The degeneration has been observed to be especially intense in the neighborhood of old extravasations of blood, beneath the peri- and endocardium.

[1] Barclay, Lancet, Jan. 31, 1863.

[2] Hawtrey Benson (Dublin Journal, 1872); Ehrlich; Waldeyer; Simon (Thèse).

[3] Craigie; Biesiadecki; Lancereaux (Atlas); Page (Brit. Med. Journal, 1851); Feltz (Gaz. Méd. de Strasbourg, 1864).

[4] Ehrlich, Inaug. Diss. p. 13.

Pleuræ.—Effusion into the pleural cavities is very common in leucocythæmia, sometimes on one side only, sometimes on both. It may be due to pleurisy, to pleural growths, or may be part of a general œdema. Hypoxanthin was found in the effusion by Andræ. Lymphoid growths occur occasionally on the surface of the pleura, as grayish-white tubercles, consisting of lymphoid cells, which are said to be derived from the connective-tissue elements of the membrane.

Lungs.—Disseminated alterations are occasionally found in the lung in leucocythæmia, although less frequently than in Hodgkin's disease. The pulmonary capillaries may become distended with white blood-corpuscles,[1] and these may even occasionally block up vessels, leading to the infarction of wedge-shaped areas, in which congestion, extravasation, and degeneration may occur. Minute scattered hemorrhages may also result from the capillary obstruction, and the extravasated blood may fill the air-cells, in which red and white corpuscles are seen mingled with a reticulum of fibrin. In some places this extravasation may undergo caseation and closely simulate a tubercular process.[2]

Actual growths may also occur. These are said to begin by an infiltration of the mucous membrane with lymphoid cells, which cause, first, thickening and opacity of the membrane, and secondly, a villous growth from it which may narrow the calibre of the bronchi, and even entirely obliterate those of small size.[3] The cells may infiltrate the walls of the bronchus and extend outside it into the adjacent lung tissue, the elastic elements of which may be observed among the cells. Between the latter a retiform stroma has also been traced; the structure of the growths closely resembling that of the new growths in the liver and kidneys. In the substance of nodules, which appeared uniformly gray, numerous nests have been found, which looked like lymph follicles, inserted into the tissue. Sometimes several such areas may coalesce into large masses. They bear considerable naked-eye resemblance to tubercles, but are distinguished by their usual freedom from caseation, such as would almost certainly accompany tubercular formations of the same size. No doubt most of the deposits described as tubercle by the earlier observers were really of this nature.

Cavities may even result from this lymphoid infiltration, and the resemblance to "tubercle" may thus be increased. Böttcher has found that the walls of the cavities present the remains of lung tissue,

[1] Isambert and Robin, 1856.

[2] Ollivier and Ranvier, Arch. de Physiologie, 1869.

[3] Böttcher, Virchow's Archiv, 1866.

and thus it is evident that a process of lung destruction has taken place, and that the cavities are not merely dilatations of bronchi. There is, however, no evidence of such softening and excavation as that which gives rise to tubercular cavities. The smaller cavities are directly related to bronchi, and therefore it seems probable that they arise by ulceration from the tubes, possibly commencing in small dilatations. In several cases in which phthisical excavations have been described, it is probable that they have been of this nature. But the appearances in the lung, as elsewhere, have in one or two cases been those of true tubercle. Œdema of the lung is sometimes present, apparently as part of general dropsy.

Brain.—The vessels of the meninges are found post mortem to be distended with pale blood, or pale clot. Obstruction of the meningeal arteries by aggregations of pale corpuscles was found by Dr. Bastian. Minute lymphoid growths in the meninges have been described in one or two cases. (Kelsch, Murchison.) In the brain-substance hemorrhage into the perivascular sheaths is common. In cases in which the hemorrhagic tendency is well marked, cerebral hemorrhage sometimes occurs. Eight such cases are on record. There are almost always multiple hemorrhages in these cases, and the separate extravasations may be very numerous. In one case there were seven separate hemorrhages, one of which, 2½ inches long, had evidently been formed by the coalescence of several smaller extravasations.[1] In another case the brain is said to have been "riddled" with minute hemorrhages, and in one recorded by Dr. Hawtrey Benson as many as fifty separate extravasations were counted. Although there are usually many foci of extravasation of small size, there may be one large hemorrhage which may burst into the ventricles.[2] Hemorrhage into the spinal meninges was found by Blache,[3] without any source being discoverable. The only change which has been found in the spinal cord itself is the presence in it of the blood crystals. (Lauenstein.).

Skin.—The skin is occasionally the seat of furuncles and ecthymatous pustules, and in rare cases of growths.[4] In the remarkable case recorded by Biesiadecki there were small tumors projecting half a line above the surface of the skin. Some merely infiltrated the superficial, others the deeper layers of the corium. The larger growths extended into the subcutaneous tissue, but were sharply limited, while the limit of the smaller growths was less distinct. They were composed of round cells, the size of blood corpuscles, with ramifying connective tissue cells; many of the round cells had undergone fatty degeneration. Biesiadecki believes that the furuncles occasionally observed may have their origin in similar growths.

A remarkable subcutaneous growth in the tissues over the sternum occurred in a case recorded by Dr. Shingleton Smith.[1] The growth, although it ultimately infiltrated the sternum and the anterior mediastinum, and extended up into the neck, appeared to commence in the structures in front of the sternum. It was regarded as a primary affection, but this hypothesis seems scarcely tenable, since, although it was noticed before the abdominal enlargement, it was only the size of a walnut when the spleen reached the iliac bone, and the white and red corpuscles were in equal numbers.

Bones.—The bones are occasionally found diseased in leucocythæmia, the change chiefly affecting the marrow. The association of bone-growth and blood-change was first noticed by Ranvier,[2] and its occurrence in splenic leucocythæmia has been carefully studied by Neumann and others. The frequency of the affection cannot at present be determined. It was thought to be invariable by Neumann. In many instances since the change has been known, the bones have been examined carefully, and found to be, in all respects, normal. There are, however, at least fourteen cases on record[3] in which a very marked alteration of the marrow was found. The change resembles in many characters that which has been found occasionally in pernicious anæmia, and in some cases of lymphadenoma. The medulla is changed in consistence and aspect, and is increased in quantity. Instead of its normal red color, it is pale gray, or reddish gray, or reddish yellow, and often "dirty" in appearance. It is diffluent and slimy in consistence, so that a small portion placed on a glass plate will spread over the surface. Sometimes it is almost purulent in aspect, and a collection of fluid may result, closely resembling an abscess. When pale gray, or greenish yellow, and jelly-like, it has been observed to become redder after a brief

[1] Reincke, Virchow's Archiv, vol. l.

[2] Troisier and Raymond, Bull. de la Société Anatomique, 1873, p. 693.

[3] Bull. de la Acad. de Méd. 1856.

[4] Lauenstein, Deut. Arch. für kl. Med. 1876; Biesiadecki, Stricker's Med. Jahrbuch, 1876, p. 233.

[1] Brit. Med. Journal, 1874, p. 233.

[2] Journal de l'Anatomie et de Physiologie, March, 1867.

[3] Those recorded by Biesiadecki, Huber, Keussner, Mosler (two cases), Neumann (two cases), Ponfick, Schlepern, Ranvier, Kelsch, Foix and Cornil, and H. Wood. This is exclusive of the cases in which there was not marked leucothycæmia.

exposure to the air. In one or two cases the appearance of the medulla has been somewhat different. In a case, for instance, described by Ponfick, it was red and firm, and the section resembled closely a section of the spleen. In it were numerous areas, sharply limited, some dark red, others pale, and believed to be infarctions, from their characters and their similarity to distinct infarctions which were observed in other organs in the same case.

Externally, the affected bones may present nothing to indicate their change, and may be indeed normal, so far as the osseous tissue is concerned. More frequently there is an atrophy of the cancellous tissue, and the compact substance may also be reduced in thickness. In one case, in which the change had existed for a long time, this had occurred, and the bones were enlarged and very soft. (Mosler.) The outer thin shell of bone may finally be perforated, especially in the ribs, and a growth from the interior may invade the periosteum.

Under the microscope, when the change is considerable, the fat cells are seen to have for the most part disappeared, and the tissue appears to consist of the same elements as are seen in the blood—great numbers of lymphoid cells and red blood corpuscles. Besides the cells resembling leucocytes in size and aspect, there are others, smaller, containing a large nucleus, and resembling the cells of lymphatic glands. Sometimes cells are seen larger in size, and containing several lymphoid corpuscles. In some cases intermediate forms between the white and red corpuscles have been observed; but in other cases they were not more abundant than in the blood, and in some they could not be found. Many cells containing red blood corpuscles were found by Ponfick, in a case of leucocythæmia, in marrow which appeared healthy.

The vascular structure of the medulla is sometimes normal in character; more commonly it is changed. The vessels are fewer than normal; the ordinary capillary network is absent (Neumann), and the vessels which can be distinguished are chiefly arteries, the walls of which are often infiltrated with leucocytes. They usually contain many white corpuscles, and may be visible to the naked eye as whitish spots and lines. In several cases the minute crystals, which are often so abundant in this disease after death, have been found in the changed medulla. In most instances in which the change was considerable, all the bones examined presented it, although it was usually more marked in some than in others. In those bones which possess much spongy tissue —the ribs, sternum, vertebræ—it was most considerable · but it has also been well marked in the diploë of the crania bones, and in the long bones—humerus, femur, tibia, and fibula. In a case described by Ponfick the affection of the different bones was not uniform—some were scarcely at all diseased; others, as the tibia, considerably altered.

Retina.—Changes in the retina are frequent in leucocythæmia. The vessels are the parts chiefly affected, the most conspicuous change being the occurrence of numerous extravasations of blood. The larger hemorrhages are situated in the outer layer of the retina, especially in the layer of rods and cones, and in places may even bulge the membrana limitans externa, and, when large, may effect a detachment of the retina from the choroid. Smaller hemorrhages are situated in the inner layers, chiefly, in some cases, towards the periphery of the retina, and occur especially in the inner granule layer, and in the ganglion cell layer. In some cases the hemorrhages have been distributed equally in all layers. Those in the fibre layer have a tendency, when small, to extend between the fibres in the direction of least resistance. The seats of old hemorrhages are marked by brownish pigment. The capillary vessels are usually filled with white corpuscles, which have accumulated in them, and which in places distend them; in the vessels a little larger than capillaries the red and white corpuscles are present in the proportion usual in the case. Adjacent to the capillaries, red corpuscles lie in the tissue. The larger hemorrhages are due to rupture of vessels, which were found by Roth to present distinct fatty degeneration, especially in the periphery. The larger vessels may be seen to be surrounded with lymphoid cells. Lymphatic growths were found in the retina, in one case, by Leber; and he was inclined to ascribe the hemorrhages in all cases to the presence of these growths; but with this, as Reincke pointed out, the character of the hemorrhages is scarcely compatible. The structural elements of the retina are usually little changed, except in the neighborhood of the hemorrhages. Adjacent to these, degeneration of the nerve fibres, and swelling of the fibres of Müller, have been observed. Where the hemorrhages are very large, these degenerative changes may result in almost complete destruction of the retina at the spot. The choroid is usually little changed, but lymphoid growths have twice been found in it.

Symptoms.—The pathological changes which underlie leucocythæmia have been seen to be profound and widely spread through the organs and tissues of the body. The symptoms which those changes produce, and which characterize the dis-

ease, are correspondingly considerable in degree, and extended in range. They may be referred to the four sets of changes which are to be traced in a developed case of leucocythæmia; the change in the blood, the enlargement of the spleen, the enlargement of the lymphatic glands, and the disseminated changes, due to blood stasis and to growth, which occur in various organs. Thus, as a consequence of the blood change there are pallor, dyspnœa, languor, headache, and other nervous symptoms; effusion into the subcutaneous tissue and serous cavities; serous fluxion from the mucous membranes; and hemorrhage in various situations. The splenic enlargement leads to abdominal distension and to the presence of a palpable tumor, to local pain, and to pressure effects on the functions of the stomach and lungs. The enlargement of the glands leads to various local tumors, and sometimes to symptoms due to their pressure, internal and external. Lastly, the changes in organs give rise to symptoms, often troublesome enough, connected with the mouth, throat, stomach, intestine, liver, kidneys, lungs, and eyes.

It will be convenient to consider first the early symptoms of leucocythæmia, and then the symptoms of the developed disease in greater detail as they are produced by the affection of the several tissues and organs.

Early Symptoms.—The early symptoms of leucocythæmia vary considerably, and their character is influenced largely by the preceding conditions of health. An analysis of 108 cases in which the early symptoms were noted shows that those which occur most frequently are due to the splenic enlargement; abdominal swelling, or a distinct tumor in one-half of the cases; splenic pain in one-quarter of the cases. Abdominal enlargement, or a sense of fulness, was in the majority of cases the first symptom; splenic pain, although a frequent early symptom, is rarely the first to be complained of. Next in frequency among early symptoms are the effects of the anæmia; weakness, languor, pallor, dyspnœa. Next to abdominal enlargement, weakness was most frequently the first symptom complained of. Digestive disturbances are common. In one or two cases excessive appetite was noted early in the disease, and in a few cases, vomiting or diarrhœa. In a considerable number of cases hemorrhages occurred soon after the commencement, generally from the nose, rarely from the bowel, stomach, or uterus. In other cases œdema occurred. In a few cases epistaxis or œdema of the feet was the first manifestation of the disease.

The following is the order of frequency of the *early* symptoms, beginning with the most frequent: abdominal distension; an actual tumor; splenic pain; weakness; pallor; digestive disturbance; dyspnœa; hemorrhage; œdema; cough. Of *first* symptoms the most frequent is also abdominal enlargement, and then follow, in the order of frequency: weakness; splenic pain; an actual tumor; digestive disturbance; pallor.

Blood.—The change in the condition of the blood in leucocythæmia gives rise to some of the most obtrusive and most troublesome symptoms of the disease. Some of these it produces directly, either by the disturbances of the circulation, œdema, and hemorrhage, to which it gives rise; others, indirectly, by interfering with the functions of the several organs. The alterations in the tint of the blood, and its microscopical characters, have been already described, and the mode of examining it will be further considered in the section on Diagnosis. The pale color of the blood is conspicuous in a drop obtained from the finger, and is shown strikingly in the paler tint of all the structures which owe their color to the blood. The skin is white, and sometimes has been compared to marble in appearance. The mucous membranes of the mouth and conjunctivæ are pale, as in simple anæmia. As the anæmia progresses, the defect in the red corpuscles leads to dyspnœa, to disturbance of cerebral function, and to prostration.

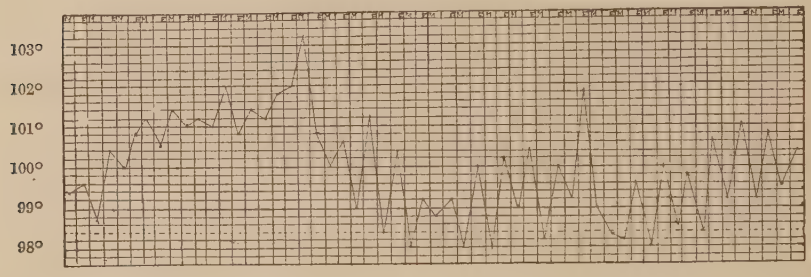
Temperature.—In a large number of cases of leucocythæmia there is elevation of the temperature. It is most marked towards the close of the disease, but may exist for a long time previously, and, probably, often commences early in the disease. Occasionally the temperature, previously raised, sinks to the normal just before death.

The frequency with which there is pyrexia is difficult to ascertain, since the existence of slight pyrexia may easily pass unnoticed, and in most recorded cases of leucocythæmia the temperature has evidently not been taken. In only 47 of the cases collected was the state of the temperature recorded. Forty-one were cases of primary splenic leucocythæmia, and of these the temperature was raised in 30, and is stated to have been normal in 11. The remaining six cases were instances of the lymphadeno-splenic form, and of these there was pyrexia in five, and the temperature was normal in only one. Out of the total of 47 cases the temperature was raised in 35 and normal in 12. It seems, therefore, that in three-quarters of the cases of leucocythæmia there is pyrexia A similar conclusion has been suggested, even more forcibly, by individual observation. Sir William Jenner, who some years ago called attention to the great frequency

of pyrexia in the disease, has lately stated that he has found it an almost invariable symptom.[1]

The temperature when raised presents considerable variations, commonly being much higher in the evening than in the morning, rarely highest in the morning. The highest point reached has varied much. In a few cases the pyrexia is said to have been slight, but in only one out of twenty-four pyrexial cases in which the temperature was measured, was the highest point below 100° F. In rather more than half the cases (fifteen) the highest point was between 100° and 102°; in six it was 102° or 102·5°, in two others a temperature of 103° was occasionally reached; and in one case the highest point was 105°. The morning fall may be slight, the elevation being continuous, or it may be so considerable as to impress on the fever a remittent or intermittent type. Both these characters are presented in the accompanying tracing (Fig. 77). Sometimes irregular pyrexial periods alternate with periods in which the temperature is normal. When the variations are marked, the attacks of pyrexia may be accompanied with shivering and sweating, as in hectic and almost as in ague,

Fig. 77.



Temperature chart of a case of splenic leucocythæmia, showing the two types of pyrexia, the continuous and remittent types. From a case in University College Hospital, under the care of Dr. Wilson Fox.

and this in patients who have never been exposed to malarial influences.

The cases in which there is most fever are usually those of rapid course, considerable dropsy, and extensive hemorrhage. The pyrexia does not appear to be related to the size of the spleen, or to the degree of the blood change.

Spleen.—The splenic enlargement which characterizes leucocythæmia, as it is the earliest pathological change also, in most cases gives rise to the earliest symptoms of the disease. But enlargement of the spleen does not commonly give rise to symptoms until its degree is considerable; hence, when subjective symptoms arise, the organ is usually large. The enlargement being uniform, its signs are those typical of a splenic tumor. When very slight, increased dulness in the position of the spleen may be its only sign, but when larger, the spleen descends below the ribs, and is borne forward by the costo-colic ligament, on which, in health, its lower extremity rests. It descends in front of this, and of the splenic flexure of the colon, and thus forms a superficial tumor in the left hypochondriac region, having the characters described as those of a splenic tumor in the article on enlargement of the spleen. The notch is almost always distinct. When the enlargement is great, two or three other indentations, which often exist in the anterior margin, may be so exaggerated as to be perceptible to touch. The lower extremity of the enlarged organ may be at the level of the iliac crest, and its anterior edge may reach the middle line. When the increase in size is extreme, the spleen may occupy the whole left half of the abdomen, displacing the intestine, reaching the spine behind, and extending an inch or two beyond the middle line in front. It may descend into the iliac fossa, and even into the pelvis, where its extremity may be detected, behind the uterus, on a vaginal examination (Spencer Wells). The splenic tumor usually moves with respiration, even when large, but occasionally its movement is interfered with by adhesions. When not fixed, it may be altered in position by posture. The degree of enlargement may vary from time to time, partly from variations in the morbid state of the system, and also in dependence on physiological conditions. It has been observed to become larger after a meal,[1] and also to be larger in the morning than in the evening.

Friction may sometimes be heard over the tumor, and a friction fremitus felt. A murmur, systolic in time, and analo-

[1] Clin. Soc. Discussion, Lancet, 1876, vol. ii p. 787.

[1] Dr. George Johnson, Lancet, Jan. 1870.

gous to the uterine souffle, may also be occasionally heard in the enlarged spleen. This is not special to leucocythæmia.[1] The enlarged spleen commonly causes an unpleasant feeling of distension, often amounting to considerable distress. This is always greater when the stomach is full, and sometimes exists only after meals. The tumor may be tender on pressure, or may be the seat of considerable spontaneous pain, either dull and constant, from the tension and weight, or sharp and lancinating, in consequence of either temporary acute enlargement, or local attacks of peritonitis. Such stabbing pain is often felt over one part of the spleen only.

The pressure which the spleen exercises interferes with the functions of adjacent organs, especially with that of the stomach. Vomiting and indigestion from this cause are frequent. Interference with the descent of the diaphragm may produce dyspnœa, or increase that which existed before, and the interference with the action of the heart, intensified by the gastric disturbance, may give rise to troublesome palpitation.

Glands.—The enlargement of the lymphatic glands rarely gives rise to symptoms except those of the local swellings. They do not commonly attain a sufficient size to interfere with movement or to produce symptoms by compressing adjacent parts. Hence the enlargement of the thoracic and abdominal glands commonly escapes notice during life. In rare cases the enlarged mesenteric glands can be felt. The superficial glands give rise to small soft tumors freely movable. In these respects the splenic forms present a marked contrast to the cases of lymphadenosis. I have not been able to find a case of primary splenic leucocythæmia on record, in which even dyspnœa was occasioned by the pressure of the enlarged glands on the air-passages, although in lymphadenoma this is a not uncommon cause of death. During the last few days of life in splenic leucocythæmia, as in Hodgkin's disease, the glands often present a remarkable diminution in size.

In the cases which have been spoken of as the lymphadeno-splenic form, the enlargement of the glands occurs early and is considerable. It may give rise to the symptoms and effects seen in Hodgkin's disease and described in the next article.

Bones.—The alteration in the marrow of bones which occasionally occurs in leucocythæmia is not usually manifested during life by any symptoms. In rare instances, when the degree of change is considerable, the bones have been tender and even painful. In a case, for instance, recorded by Mosler, there was great tenderness over the bone chiefly affected, but no symptoms pointing to other bones in which the affection of the medulla was slighter. The tenderness may sometimes be extreme. When the medullary change is advanced, the bone may be swollen. In another case, also recorded by Mosler, pains existed for several years in the sternum, which became ultimately swollen and soft, and there was enlargement of the iliac bones, some of the ribs, and the left trochanter.

Circulatory System. — The heart may be displaced upwards by the abdominal enlargement, and may even come to be almost horizontal in position. The displacement may be upwards and to the right, as in a case recorded by Dr. Walshe, in which the heart's apex was within an inch of the sternum and three inches of the clavicle. The heart suffers in its function as in simple anæmia. It is frequently slightly dilated and its action is disturbed by the anæmia and pressure, so that palpitation is a very common symptom. The pulse is, in most cases, unduly frequent; and the frequency, during the attacks of functional disturbance, may be extreme, 160 or 170 per minute. A venous hum is often to be heard in the veins of the neck, and a systolic murmur at the base of the heart. A systolic apex murmur has also been frequently noticed, and regarded as mitral, but probably in some cases was merely ventricular in origin.

The peripheral circulation may be disturbed, partly by the blood state, partly by the cardiac weakness, partly by the accidental obstruction of capillaries by aggregations of corpuscles, partly by changes in the vascular walls.

Effusion of serum into the cellular tissue and cavities of the body is very common; indeed it is almost invariable in the later stages of the disease. It may occur, even in an extreme form, from the blood state, but its amount is often increased by pressure on the veins by enlarged glands. The subcutaneous œdema may be so great as to separate the epidermis, or rend the cutis as in lineæ albicantes, and into the spaces thus formed blood may be effused. The œdema may extend to the scrotum and trunk. Ascites is frequent, and sometimes is so great as to necessitate paracentesis. When the effusion is considerable, there are usually enlarged glands pressing on the portal vein. Hydrothorax may occur, with or without inflammation of the pleura. When alone it is usually slight; when there is pleurisy the amount of effusion may be large, and the patient's life—since the effusion is often double—may be seriously imperilled by it. Hy-

[1] It was long ago pointed out by Dr. Hare that such a murmur is distinctive of a splenic from a renal tumor.

dropericardium may also occur, but rarely in sufficient degree to attract attention during life.

Hemorrhages, external or internal, are very frequent in leucocythæmia. Their precise mechanism is unknown. It has been customary to refer them to a degenerated state of the bloodvessels, the consequence of the anæmia, and to this must probably be added the occurrence of local obstructions to the circulation, due to the blockade of vessels by aggregations of white corpuscles, the watery state of the blood, by which its flow is facilitated, and the imperfect character of the coagula. The hemorrhages may occur in a similar degree in cases of simple splenic tumor without any excess of leucocytes in the blood. Whatever be their mechanism, the frequency of the hemorrhages constitutes them a very salient feature of the disease. They may occur so frequently, and so abundantly, that the case may be regarded as one of the hemorrhagic diathesis. They may be among the earliest symptoms. Epistaxis has been noted in one case for six years before death.[1] In other cases the hemorrhage only occurred towards the last. By the additional anæmia thus caused, the downward progress of the patient is often accelerated.

The frequency with which hemorrhage occurs has been variously stated; most authorities consider that it is present in three-fourths of the cases. In those I have collected it is mentioned less frequently. Out of 150 cases of which the record was sufficiently full to lead to the expectation that, if present, the symptom would have been mentioned, hemorrhage, external or internal, occurred in eighty. The most frequent source of hemorrhage is the nose. Epistaxis is often profuse and difficult to control, and may be the immediate cause of death. It occurs frequently, and in some cases has occurred daily. The next most frequent source of hemorrhage is the bowel, commonly in association with diarrhœa. It may result from ulceration, or may take place from the surface of the mucous membrane: no breach of surface being visible post-mortem. Hæmatemesis is less frequent, but was present in several cases, and in one or two was the cause of death. As already stated, it may also occur without ulceration. The phagedenic ulceration of the gums is sometimes accompanied by hemorrhage. Hæmoptysis and hæmaturia are less common occurrences, but have been noted in several cases. Hemorrhage from the uterus occasionally occurs in women. Traumatic causes may also, as in hæmophilia, give rise to hemorrhage very difficult to arrest. Most cases of excision of the spleen have proved fatal from this cause, and in two cases extraction of a tooth gave rise to extreme hemorrhage, which in one was fatal.

Internal hemorrhages also occur. Of these the most frequent, although the least important, are the cutaneous extravasations. In some cases, however, they are serious from their size and number. They may also occur beneath the conjunctiva. Next in frequency, and first in importance, are extravasations into the cerebral substance. These occurred and caused death, with symptoms of apoplexy, in eight cases. Extravasations into the muscular substance of the heart were noted in one case, and in one extensive extravasation took place into some of the larger joints.[1] Hemorrhage may occur into the connective tissue beneath the skin, or between the muscles. In one case an extensive extravasation occurred among the muscles of the back, forming a large tumor, which was opened, and the patient died in consequence.[2] In another case a large extravasation occurred behind the peritoneum. The peritoneal cavity was the seat of hemorrhage in several cases, in one from some vascular adhesions, which became torn by the weight of the spleen; in one from thickened omentum; in one from a puncture in paracentesis; in several from excision of the spleen.

Respiratory System.—In nearly all cases of leucocythæmia there is shortness of breath, and the dyspnœa is mainly to be attributed, as in simple anæmia, to the diminished capacity of the blood for oxygen. There is always a diminution in the number of red blood corpuscles, which are the chief means for the conveyance of the oxygen from the lungs to the tissues. It is also in part to be ascribed, as Trousseau pointed out, to the pressure exercised by the enlarged spleen on the thorax; and the dyspnœa may thus be intensified by the recumbent posture, and by a heavy meal. It may also be in part due to changes within the lung tissue—minute growths or obstruction of the lung capillaries by white corpuscles. The dyspnœa is commonly not noticed during rest, but becomes intense on exertion, and in extreme cases the slightest movement produces an agony of breathlessness.[3] Pettenkofer and Voit[4] found that during rest neither the oxygen absorbed, nor the carbonic acid given off, differed from that absorbed and given off by a

[1] Patchett, Lancet, May 18, 1872.

[1] Klemme, Inaug. Dissert. Cassel, 1863; Schmidt's Jahrb. vol. cxxxi. 1866, p. 173.

[2] Vidal, Gaz. Hebd. 1856, Obs. II.

[3] As in a case recorded by Dr. Day, Clin. Hist. and Comment. p. 184, in which towards the last "scarcely any red corpuscles could be seen in the blood."

[4] Zeitschrift f. Biologie, 1869.

healthy man. Hence, as Mosler points out, the blood corpuscles probably, at rest, perform an extra amount of work, analogous to that which, in health, they perform during muscular exercise, but there is no reserve of capacity for carrying oxygen which can be used on the occasion of muscular exercise, and hence the dyspnœa on exertion. It is possible that the white corpuscles may to some slight extent assist the red as oxygen carriers. In one case of leucocythæmia the diminution in the number of the red was greater than (according to other observations) is compatible with life, but there was such an increase in the white corpuscles that they were more numerous than the red. Lymph has been observed to redden slightly on exposure to air.

Other causes sometimes increase the amount of dyspnœa. Bronchial catarrh is common. Various lung and heart complications may coexist, — pleurisy, hydropericardium, degeneration of the heart's substance. In cases of the lymphadeno-splenic form, glandular tumors in the posterior or anterior mediastinum may compress the lungs or bronchi.

Cough is frequent, due to the various sources of irritation of the pneumogastric, and it may be an early symptom of the disease. The voice may become weak and hoarse.

Alimentary Canal. — The mouth and throat are occasionally diseased. In cases in which the hemorrhagic tendency is well marked, the gums may bleed without breach of surface. Lymphoid growths in the gums and pharynx may lead to ulceration, and a low form of stomatitis and pharyngitis, which has been described by Mosler as *stomatitis* and *pharyngitis leukæmica.* But such growths are very rare in splenic leucocythæmia. Their relation to an excess of white corpuscles in the blood is very doubtful. Occasionally a phagedenic ulceration of the gums has been present, analogous to that of scurvy, and Mosler suggests that these low forms of stomatitis may be in part due to the contamination of the blood by the abnormal substances which have been found in it on chemical examination, and which may be deleterious.

Gastric Symptoms. — The appetite is usually little affected until the later stages of the disease, when it is often much diminished, and the inability to take food contributes to the increase of the cachectic state. In a few cases, at the outset of the disease there has been excessive appetite. Thirst is occasionally a prominent symptom, especially when there is pyrexia. The direct effect of the spleen on the stomach may interfere with the gastric functions. Pressure on the viscus often leads to vomiting of food, or, when food is retained, to its imperfect digestion. The pressure, it is also to be noted, reaches its maximum after a meal, when its effect is most injurious. The spleen has been observed at that time to increase in size. The stomach derives part of its blood supply from the splenic artery, and the variations in the blood supply to the spleen will be attended by variations in the blood supply to the stomach. Vomiting, however, although occasional, is not often a troublesome symptom. It was so in only five out of 160 cases. Hæmatemesis is an occasional symptom, and may be the immediate cause of death. It occurred in eight cases. It may occur without any visible breach of surface, probably from rupture of minute vessels (when the blood state favors hemorrhage) during the sudden congestions to which the stomach is liable in this disease. It sometimes, however, is the result of the ulceration of lymphoid growths.[1]

Intestines.—The bowels are frequently disordered. Rarely there is constipation, and chiefly in the early stages. Diarrhœa is extremely common. It is occasionally an early symptom, but more frequently occurs during the later stages, and is a very common cause of death. It is usually simple, but occasionally dysenteric, with much mucus and tenesmus, and sometimes may be accompanied by considerable hemorrhage. When simple, it may be due to intestinal catarrh, or may be the accompaniment of lymphatic overgrowth in the follicles, with or without ulceration. The occurrence of these lymphoid growths, however, by no means involves diarrhœa. They may be accompanied by no intestinal symptoms, or there may be constipation with tenderness of the bowels. On the other hand, just as in the stomach, considerable hemorrhage may occur without breach of surface being visible after death.

The Liver, as already stated, is frequently enlarged in leucocythæmia, and the enlargement may be great. Its nature cannot be recognized during life, since the new growths, when they occur, are of so small a size as not to be recognizable on external examination. The enlargement may add considerably to the patient's discomfort, increasing the distension of the abdomen, which results from the splenic tumor. It is not often that there is any recognizable interference with the liver functions. Jaundice has been present in a few cases, but when considerable has appeared to be due to the compression of the bile duct by enlarged glands in the hilus of the liver. A slighter degree of jaundice has been pres-

[1] Mosler, Virchow's Archiv, vol. lvi. 1872, p. 25, and vol. lvii. p. 532.

ent in several cases—a peculiar yellowish tint, to which the term "icterus lienalis" has been applied. Mosler suggests that it is probably due to resorption in the liver, just as in cirrhosis, on the ground that interstitial changes are so frequent in the liver in leucocythæmia. But the tint, in distinct degree, may be observed in cases of splenic anæmia, where there is no excess of white corpuscles in the blood, or any enlargement of the liver, or evidence of disseminated growths in it, or other organ. The enlarged spleen cannot itself cause jaundice, and its influence can only be exerted by means of the blood. There is always, in these cases, profound anæmia. Hermann has shown that there is such a thing as an anæmic icterus; for after water had been injected into a vein he found bile in the blood. In such a case the change in the blood probably lessens its power of destroying or changing the bile pigment absorbed from the intestine, which the blood is known in health to possess. In a case of considerable jaundice, observed by Mosler, bile acids were found in the urine, but their presence in the blood appeared to have no prejudicial influence, such as might be inferred from their power, which Dr. G. Harley observed, of destroying red corpuscles. The degree of leucocythæmia lessened instead of increasing during the existence of the jaundice.

Ascites is a common symptom in leucocythæmia. Its occurrence is always furthered by the tendency to serous effusion, and sometimes a slight ascites has appeared to be only part of the general dropsy. In other cases it has been evidently increased by some cause of portal congestion. Enlarged glands in the portal fissure may press on the portal vein. In other cases the obstruction may, as Ollivier and Ranvier suggest, be due to the accumulation of white blood corpuscles in the capillaries of the liver, an accumulation which has been repeatedly demonstrated after death. It is also possible that perivascular accumulations of corpuscles may compress many of the portal venules, and interfere with the flow through them. Ollivier and Ranvier suggest that the accumulation of corpuscles in the peritoneal radicles of the portal vein may prevent the effusion of serum in some cases, but this is an assumption which is destitute of proof or of any probability from analogy. The degree of ascites is usually moderate, but may be so great as to necessitate paracentesis. Hemorrhage may occur into the cavity of the peritoneum from many sources, and the extravasation of blood may give rise to considerable, even fatal, peritonitis. Local peritoneal inflammation may also occur from the splenic enlargement. General peritonitis, from any other cause than hemorrhage, is very rare.

Urine.—The quantity of urine varies in different cases, and at different periods of the same case. It is occasionally diminished from the first. More frequently it is increased towards the end. It is commonly very acid in reaction, and has a medium or high specific gravity, 1020–30. Deposits of lithates are frequent, especially in febrile cases. Under the microscope, crystals of uric acid and of oxalate of lime may often be seen.

The amount of chlorides was found by Schmuziger to be usually from 100 to 150 grains. In Vogel's case the quantity was larger. The phosphates and sulphates were found in Vogel's case to be of normal quantity. The amount of urea excreted probably differs little from that of health, varying with diet, rather than in consequence of the morbid state. Jakubasch found it diminished in one of Mosler's patients, and Salkowski found it on the average less than in health: Thierfelde and Uhle, on the other hand, found it much increased. So, also, did Berrell.[1] In Schmuziger's case, the daily excretion was a little below the normal, varying from 200 to 400 grains.

The amount of uric acid excreted is always increased, often considerably. Ranke[2] found it increased by one-half, from 0·648 to 0·915 parts per thousand. Pettenkofer and Voit found the average of five normal men to be 0·872, while that of a leucocythæmic patient was 1·424, an increase of 64 per cent. Ossikovsky also found an increase, the excretion being on an average about 22 grains (1·5 grammes), in the 24 hours. A similar increase was noted by Schmuziger and by Berrell. In the case of the latter, a boy of 17 excreted 18·28 grains daily, 1·50 parts per thousand—the average for a boy of the same size and weight, on scanty diet, being, according to Parkes, only six grains. Bartels found an enormous increase in one case, the daily excretion being 4·2 grm., about 60 grains, and mentions another case of leucocythæmia with an enormous spleen, in which concretions of uric acid were frequent, and death occurred after renal colic and anuria of three days' duration.[3] Virchow and Ranke ascribed the increase in the uric acid to the functional over-action of the enlarged spleen, since uric acid has been found in many cases in the splenic pulp. Mosler, however, did not find that the increase of the uric acid was constant, but thinks that it occurs chiefly during the febrile paroxysms, and refers it simply to incomplete oxidation during the pyrexia. Salkowski found the increase, although in one case considerable (2·0 grm.), was in an-

[1] Med. Times and Gazette, I. 1868, p. 285.
[2] Virchow's Archiv, Bd. 5, p. 108.
[3] Deutsche Klinik, 1856, p. 23.

other slight. He showed that the increase, even when permanent, is not proportioned to the size of the splenic tumor. This has also been clearly established by Mosler in a case of splenic anæmia, in which there was a distinct increase. Reincke thought that the urea and uric acid are in normal relation to one another, but that the uric acid is increased. He found the urea 2·5 to 2·8 per cent., and the uric acid 0·06 to 0·11 per cent. Hoffmann found the proportion to be 1 to 29 or 36, the uric acid being 0·08 to 0·1 per cent., and the urea 3·07 and 3·22 per cent. In Berrell's case the proportion was 1 to 27.

Berrell found the chlorides to be less, and the sulphates and phosphates more abundant than the average.

Hypoxanthine has been found in the urine by Körner, Salkowski, and Andrae, but only in small quantities. It seems not to be invariably present. Cases in which it could not be discovered have been published by Salkowski, Huber, Reincke, and Salomon. The last observer found a body allied to hypoxanthin, and Andrae thought that he found xanthin.

Lactic acid was found in one case by Körner, but could not be discovered by either Salkowski or Salomon. Salkowski found very small quantities of formic acid.

Albumen is present in the urine not unfrequently, apart from the complication of concurrent Bright's disease. In several cases in which it was present in the urine, the kidneys post-mortem were found to present the morbid appearances described in the section on the Pathological Anatomy: increased size, with or without undue pallor; interstitial lymphoid infiltration; and disseminated growths. In none of these cases, however, was the albumen abundant, and in no case were casts met with. In many cases these structural changes existed without any alteration in the urine. In one case in which a trace of albumen was met with, the kidneys were found to be normal. In five other cases in which there was no post-mortem examination, albumen was present in the urine without casts or other signs of Bright's disease. In one it amounted to a sixth, and in one or two a few blood disks were found. In rare cases blood is present in the urine in considerable quantities.

Organs of Generation.—Menstruation is usually irregular and commonly arrested as the disease progresses; often early in its course. Occasionally the catamenia are at first excessive, amounting even to profuse menorrhagia. When abundant, the discharge may be dark and fetid. When there is amenorrhœa, the monthly period may be marked by some other symptoms, as by an increase in the splenic pain or by epistaxis.

Sexual power in men is apparently not specially affected. In two cases[1] a peculiar erection of the penis has been noted, coming on suddenly, unattended by any sexual feeling, lasting a week or two, and then subsiding. It has been supposed to be due to thrombosis in the corpora cavernosa.

Nervous System.— The cerebral functions suffer in a very striking manner from the altered blood. Languor and physical depression have been noticed as early symptoms in some cases, and are almost constant in the later stages of the disease. Mental failure and loss of memory are occasional symptoms. Noises in the head or ears, commonly intermittent and of arterial origin, are very common. Headache is frequent and often severe. Vertigo is occasionally complained of, and may be a very marked symptom. It may be extreme on any sudden movement, and in one case it was associated with attacks of sudden heat and sickness. When intense, it may be connected, as it so often is, with aural disturbance, of which there is sometimes independent evidence. Delirium has been present in a few cases, and has been ascribed to plugging of the minute vessels of the cerebral cortex with white blood corpuscles; a condition found in one such case by Dr. Bastian. A more chronic form of mental derangement has been noted in two cases; in one of which (recorded by Charcot and Robin) suicide was committed. Coma may occur, it is said, from the effects of the anæmia alone. The graver cerebral symptoms are probably due to capillary obstruction, or to the small hemorrhages, in part the result of such obstruction. More definite symptoms of local disease, hemiplegia and profound coma, are usually due to extravasation of blood.

Organs of Special Sense. Ear.—The very common noises in the ear have been already alluded to. Deafness is also common, especially towards the end. It sometimes comes on suddenly, and has been thought to be due to intra-aural hemorrhage. The fact has not yet been demonstrated by post-mortem examination.

Eye. Lukæmic retinitis.—The occurrence of a special change in the retina, visible with the ophthalmoscope, was pointed out first by Liebreich, and the observation has since been abundantly confirmed. The anatomical changes which occur have been already described. When examined with the ophthalmoscope, the tint of the choroid is seen to be paler than normal, a bright orange. The retinal arteries are narrow, and have the same tint. It may be distinct even by gas-light, and is very striking when viewed

[1] Louguet, Prog. Méd. 1874, 32; Klemme, Inaug. Dissert., Cassel, 1863; Schmidt's Jahrbuch, vol. cxxxi. 1863, p. 173.

with the daylight from a bright cloud, or admitted into a darkened room through a small hole. The most striking difference is in the veins, which are a pinkish or bluish-red, instead of the dark purple color which they usually present. They may be narrow, scarcely larger than the arteries, or they may be distended, especially when other retinal changes coexist. The vessels may be accompanied by bands on their sides, white or yellowish, more conspicuous on the veins than on the arteries. The optic disk itself may be normal or may be unduly pale. Occasionally it is slightly swollen and opaque; the vessels upon it being concealed as with a cloud, the margin being gradually lost in the adjacent retina. The retinal tissue may be slightly opaque, but this opacity is secondary to the other changes. Hemorrhages constitute one of the most striking appearances. They are usually small and most abundant towards the periphery, but they are occasionally of considerable size. They are often striated, the striæ following the direction of the nerve fibres. They may be observed to become paler after a little time, and a succession of fresh ones may be observed.

The centre of many of these hemorrhages is a white or yellowish-white spot, and sometimes the pale central area may be so large that the aspect is that of a whitish spot with a reddish halo. Similar spots may be observed without any accompanying extravasation. They may be very numerous, and may be grouped around the macula lutea, very much as the spots are grouped in the retinitis of Bright's disease. They are often most abundant towards the periphery. Sometimes they are of considerable size, and then may be traced to the choroid, as in one case in which Becker observed a large white prominence exactly in the position of the macula lutea, and on its margin a zone of red extravasation in which were many white dots. It was evidently a small growth. Subsequently, a second similar spot appeared between the disk and the macula lutea. In one case an extensive hemorrhage occurred into the vitreous. Hemorrhages are not always, however, the most conspicuous feature. In one case, which came under my own observation, the retina was the seat of parenchymatous swelling and the veins were greatly distended, and tortuous both in lateral and anteroposterior curves.

The extent to which these changes interfere with sight varies. The disseminated hemorrhage or white spots will produce very little effect, and the swelling of the optic disk is never sufficient to compress the nerve fibres. When, however, the changes have their seat in or near the macula lutea, central vision may be impaired or lost. In Becker's case, for instance, there was a large central defect on the field of vision. The occurrence of an extensive hemorrhage may cause complete blindness. In one case, red vision by candle-light was complained of.[1]

The Skin is usually pale, the pallor being, as has been said, sometimes a very striking symptom. The tint may be simply white; sometimes a greenish-yellow color has been observed, the "icterus lienalis" before described. In several, a slight dark pigmentation has been noted, and attention has been called to this by Dr. Greenhow. It may be so considerable as to suggest a resemblance to Addison's disease. The skin is sometimes dry; more frequently there are excessive perspirations, especially when there is hectic fever. Furuncular skin diseases are not uncommon. Petechiæ are frequent, and subcutaneous extravasations may cause soft bluish swellings.[2]

Complications. — Leucocythæmia is frequently associated with other morbid conditions, which have so little connection with the process of the original disease, that they may be regarded as its complications. Some of these, as pneumonia, are so disconnected with the lymphatic disease, or state of the blood, that they may be regarded as accidental. Others, such as fatty degeneration of the liver, or pleural effusion, are extreme degrees of changes which, when slighter, are to be regarded as parts of the lymphatic affection, or its consequences. The separation of some of these from the symptoms, as complications, is to a large extent arbitrary. This is especially the case with the various forms of serous effusion which are so frequent, the anasarca and the peritoneal and pleuritic effusions.

Pleural effusion is a condition very frequently met with. In many cases it is simply part of the general dropsy. In others lymph is formed, and all the signs of pleurisy are present. The effusion is frequently double, and usually occurs towards the last, although it is not often the immediate cause of death. Œdema of the lungs is also common. Hypostatic congestion may occur towards the end. Acute lobar pneumonia is an occasional complication, usually single, rarely extensive, but very frequently fatal. Phthisis is rare. In a few cases tubercles have been found in the lungs, and in a few an ulcerative process in new formations, disseminated through the lungs, has given rise to small scattered cavities, and to the physical signs of phthisis. In most cases, however, this has arisen in lymphatic formations, and the cavities have been, as

[1] Church, British Med. Journ. Sept. 19, 1868.

[2] Simon, Thèse, p. 15.

a rule, small, and the physical signs slight. Bronchial catarrh is common, but rarely serious in its degree.

Pericardial effusion is not uncommon, but actual pericarditis is rare, and the effusion is never great. Weakness of the cardiac walls, due to changes consecutive to the anæmia, degeneration of the fibres and extravasation of blood, may permit dilatation of the heart, and this has been a conspicuous feature in several cases. Valvular disease, when present, is usually due to degenerative changes. In one case aortic, and in several mitral regurgitation, was present.

Peri- and endo-carditis was found post-mortem in one case, but death occurred from an acute specific disease, varioloid, and to it they were probably due.

The disturbances of the circulation which occur in leucocythæmia are to be regarded as symptoms, rather than as complications of the disease. One or two of them have, however, such independent effects, as to merit special consideration.

Thrombosis has occurred in a few cases, but is much less frequent than in Hodgkin's disease, in which the circulation is often impeded by pressure on the venous trunks.

Gangrene of the fingers, the result apparently of defective supply of blood, was noted in one case, but probably preceded the leucocythæmia, and was an accidental complication.[1]

Cerebral hemorrhage is an occasional and very grave complication. It occurred in eight cases, and in each was the cause of death. The gravity arises from the fact that it depends on the local effect of a general cause, and the condition produced is widely spread through the brain, and the hemorrhage is therefore generally extensive and often multiple. Its occurrence has no relation to age. The ages of six of the patients were respectively seventeen, nineteen, twenty-two, thirty-five, thirty-five, forty. In several of the cases the hemorrhagic tendency has been well marked, in others, however, there has been no external hemorrhage. Its onset has usually been marked by sudden coma, rapidly deepening to death. In consequence of the number of the extravasations, the symptoms have in many cases been from the first general—those of a limited cerebral lesion having been absent.

Cirrhosis of the liver has been met with in a few cases. It has been regarded as an independent and accidental complication, but it must at the same time be remembered that the leucocytal infiltration and growth in the portal canals bears some resemblance, in its minute structure, to that which, in some cases, initiates cirrhosis, and that the adenoid growth elsewhere, may occasionally present a tendency to induration. In one case the kidneys also were large and fibrous.

Fatty livers are often met with. Jaundice is occasionally present, and has been already spoken of. When considerable it is usually due to the pressure of enlarged glands on the bile duct, or is a purely accidental complication. Extreme ascites may also result from the enlargement of the portal glands.

Bright's disease is an occasional complication of leucocythæmia. The most common form is a subacute parenchymatous degeneration of gradual onset, the kidneys being large, sometimes pale, sometimes mottled red, and the urine highly albuminous and containing casts, granular and epithelial. A considerable increase in the anasarca often attends it. In one case the cortex presented some atrophy, and in one or two the kidneys were large, white, and presented extreme fatty degeneration. The common form is probably only a further stage of the slight parenchymatous swelling which is so common in the disease, and gives to the organs their large size and pallor so frequently described.

Renal calculi were found after death in three cases, but had given rise to no symptom during life. Their formation is no doubt dependent on the large excretion of uric acid, deposits of which are sometimes observed in the kidney substance.

The morbid states of the alimentary canal are rarely of such independent character as to deserve separate consideration.

The skin sometimes presents pathological conditions, commonly related to the cachexia, or œdema. Furuncles occasionally occur. Pemphigus has been present in one or two cases towards the close. Erysipelas also occurs in the later stages, especially in œdematous parts.

Symptoms of Addison's disease have been noted in a case recorded by Dr. Barclay, in which the bronzing of the skin was associated with enlargement and mottling of the supra-renal bodies.

DURATION.—The insidious commencement of leucocythæmia renders the determination of its duration a matter of much difficulty. A period of ill-health, in many cases, precedes the definite symptoms of the disease. In other cases, the first indications of ill-health only attract attention when the splenic tumor and blood change have made considerable progress. In each instance it may be difficult or impossible to fix the commencement of the disease. In the latter case it will probably be post-dated, in the former, ante-dated. But since the sufferers from leucocythæmia rarely present distinctive symptoms which can be associated with

[1] Simon, Thèse, Obs. 11.

the malady until some time after its commencement, the most frequent error is to date its commencement late, and hence to assign to it too brief a duration.

The variations in the period during which there are distinctive symptoms are very great, and extend from a few weeks to many years. The most acute cases on record, in which the disease runs its course in a few weeks, are usually attended with great and rapid enlargement of the lymphatic glands and spleen, and apparently consist in an irritative process of such intensity that they can hardly be classed with ordinary cases of splenic leucocythæmia. The duration of the latter may be said to range from six months to seven years. One or two cases are on record in which the disease is said to have commenced and terminated in less than six months. Of these, one of the best authenticated is that recorded by Schreiber, in which death occurred in four months from the earliest symptom—profuse menorrhagia. But in this the hemorrhagic tendency was well marked, and it is probable that the menstrual loss was the expression of a disease already developed. There are many cases on record in which the symptoms lasted for six months only. The majority of the cases terminate within three years of their commencement, but a few last longer, four or even five years. The following table represents the duration of the disease in sixty-three cases, in which the date of the earliest symptoms could be fixed with some accuracy.

	Males.	Females.	Total.
Less than 1 year . . .	9	4	13
1—2 years	10	6	16
2—3 "	12	7	19
3—4 "	6	3	9
4—5 "	2	1	3
5 years and upwards .	3	0	3
Total . . .	42	21	63

The average duration of cases of both sexes and all ages is nearly two years, the mean of the sixty-five cases being about twenty-three months.

Sex appears to exercise little influence on duration. The average duration of forty-one cases occurring in men was nearly twenty-four months, that of twenty cases occurring in women was not quite twenty-three months.

It may be doubted whether the number of cases available for comparison is sufficient to enable an accurate opinion to be formed concerning the influence of age on duration. As far as they go, the duration appears to be greatest at the period of life in which the disease is most frequent —between thirty and forty years. This is evident from the following table, exhibiting the relation of age to duration, in sixty-five cases of the primarily splenic form.

Age at commencement.	No. of cases.	Average duration.
10—20 years . .	11	20 months.
20—30 " . .	18	22 "
30—40 " . .	18	29·8 "
40—50 " . .	12	19 "
50—60 " . .	5	27 "

The number is not sufficient to suggest any conclusion regarding the influence of sex on duration at the various ages.

Little can be said regarding the influence of individual symptoms on the duration. The cases in which enlargement of the lymphatic glands is an early symptom, run a course apparently rather more acute than others, but the number of such cases is not large. The size of the spleen appears to exercise no influence on the duration of the disease. Cases accompanied by pyrexia might be expected, from analogy with other diseases, to run a more rapid course than those in which the temperature is normal. This is probably true of cases in which pyrexia occurs early and is continuous. Many cases of long duration present considerable elevation of temperature towards the last. The cases in which there is no pyrexia frequently run a tardy course, and the exceptions to this, which are numerous, are due, in most instances, to the intercurrence of accidental causes of death, such as the cerebral hemorrhage. No direct relation can be traced between the degree of leucocythæmia and the duration of the disease. Many of the cases of longest duration presented before death an extreme increase in the relative excess of white corpuscles, and on the other hand, in some very acute cases the excess was comparatively slight.

Causes of Death.—The course of leucocythæmia may end by a gradual weakening of the patient's strength, under the influence of the progressive anæmia or repeated loss of blood; by the direct effect of that loss of blood; or by the occurrence of independent local inflammations and other diseases.

Asthenia is a more common cause of death than any other single condition. Out of sixty cases in which the cause of death could be accurately determined, the end was due to simple asthenia in twelve. The gradual increase in the blood-state tends to increasing prostration, to increasing œdema, to increasing interference with the function of vital organs, until the patient sinks, commonly from cardiac failure. Consciousness may sometimes be retained to the last, sometimes obscured by the effects of the cerebral anæmia, which is a common effect of the state of the blood, and the weakness of the heart.

Loss of blood is a frequent cause of death, and was fatal in more than one quarter of the cases, in which the actual cause of death was noted (17 out of 60).

The fatal hemorrhage is usually external, sometimes internal, into some space into which a large extravasation can take place. The external hemorrhage which is most frequently fatal is that from the nose—uncontrollable epistaxis, continuing for days, recurring whenever the plug is withdrawn from the nares. The next most frequent source of fatal hemorrhage is the stomach. Hæmatemesis was the cause of death in four cases. Hemorrhage from the bowels was fatal in three cases, in each there being also diarrhœa. Other internal extravasations causing death by loss of blood, have occurred into the peritoneal cavity and the cellular tissue. Considering how strong the hemorrhagic tendency often is, it is remarkable that fatal hemorrhage should so rarely result from traumatic causes. Splenotomy in several led to death by hemorrhage; in one of the cases of peritoneal hemorrhage, the cause was a puncture for paracentesis; and in one case death resulted from the loss of blood, which followed the extraction of a tooth and continued for two days. In cases in which hemorrhage is not the immediate cause of death, it increases the anæmia and prostration, and accelerates the course of the disease and the fatal result.

Diarrhœa is another common cause of death, which in nine cases was attributed to this cause alone, without the occurrence of intestinal hemorrhage.

Cerebral hemorrhage was the cause of death in one-tenth of the cases—six out of sixty. Such a proportion is probably too large, and may be due to the circumstance that so striking a consequence of the disease led to a careful report of the case and its termination. Apoplectiform symptoms, due apparently to anæmia of the brain, preceded death in one case. In one case the cause of death was thrombosis in a cerebral sinus.

Lung diseases constitute another frequent cause of death. Pneumonia is of these the most important, and was the cause of death in six cases. Pleurisy and œdema of the lungs are very frequent towards the last, and sometimes have appeared to accelerate the end.

Rupture of the spleen was the cause of death in one case. In the remaining cases, death occurred from some independent intercurrent malady; septicæmia in one, varioloid in one, suppuration of vulval glands in one, and diphtheria in two cases.

PATHOLOGY.—The pathology of leucocythæmia is a subject which has received much attention, has occasioned much speculation, but is still obscure. On very few points is knowledge more precise, or hypothesis more definite, than when Virchow published his opinions on the nature of the affection a quarter of a century ago. This is largely due to our want of precise knowledge of the physiology of the blood, of the origin of the corpuscles, and their fate, and of the function of the organ which is chiefly affected in the disease. The theories which have been and are still advanced regarding its nature, are determined by the varying and different opinions held on these disputed points of physiology. In considering the pathology of leucocythæmia, the chief points to be discussed are:—

(1) The relation of normal to leucocytic blood.

(2) The normal history of the white corpuscles, and the functions of the organs which are diseased in leucocythæmia.

(3) The nature of the morbid change in the blood, and the relation to it of the pathological changes in the tissues.

(4) The relation of the morbid process to the causes of the disease.

(5) The origin of the variations in the symptoms.

Lastly, The occurrence of an analogous blood-state in other diseases.

(1) *The relation of normal to leucocytic blood.*—The condition in leucocythæmia is commonly stated in terms of comparison, *i. e.*, the relative numbers of white and red corpuscles. Under normal circumstances the proportion of white to red rarely exceeds 1 to 300 (1 to 347, or nearly ·3 per cent.) was fixed as the maximum by Moleschott. Frequently the proportion is far less, 1 to 500, or 1 to 1000. The proportion is liable to considerable variations. It is increased after a meal, and is said to reach the maximum an hour after the meal.[1] Moleschott[2] found the proportion greater in children than in adults, and increased during menstruation. In observation on fifty persons he found the average numbers to be:—

In children	1 white to	226	red.
In men	1 "	346	"
In women	1 "	389	"
During the catamenia .	1 "	247	"
Average of the whole .	1 "	347	"

In leucocythæmia, as has been said, this proportion is greatly exceeded; the proportion of white to red being commonly greater than 1 to 5. A comparative statement of the relative numbers of the white and red does not, however, accurately express the condition of the blood, since there is always a double change, an absolute diminution in the number of the red, as well as an increase in the white corpuscles.

[1] De Pury, Virchow's Archiv, vol. vii.

[2] Wiener Med. Wochenschrift, 1854, p. 113.

(2) *The normal history of the white corpuscles, and the normal functions of the organs diseased.*—It is evident that, since all cells have a transient existence, such an excess of white cells may be due to their excessive formation, or to their undue persistence, in the blood; while the diminution in the red may be due to a deficiency in their formation, or to their undue destruction. A knowledge of the normal life-history of the corpuscles is therefore essential for the comprehension of their abnormal life-history in leucocythæmia.

What are the colorless corpuscles of normal blood, and what is their origin? With this problem is closely associated another: What is the relation of the blood to the normal functions of the organs which are found diseased in leucocythæmia? The two subjects must be considered together.

According to our present knowledge, the colorless corpuscles in the blood are formed from pre-existing cells of the same character (or from a protoplasmic network, according to Klein), mainly, if not exclusively, in the lymphatic organs of the body, from which they pass into the blood, directly, or indirectly by means of the lymphatic vessels. It is certain that leucocytes are thus formed in the lymphatic glands. It is probable that they are thus formed in the splenic follicles and in the follicular glands of the alimentary canal, and other similar structures, including the marrow of the bones, and it has been conjectured that they are also supplied by the thyroid and thymus glands.

The fact that colorless cells pass into the blood from the lymphatic glands is universally admitted, and is, indeed, hardly capable of dispute. It is probable, also, that corpuscles pass towards the blood from the lymphatic follicles of the intestines, since the lymphatic vessels contain corpuscles before reaching the mesenteric glands. That the spleen and the medulla of bones are normal sources of leucocytes rests also upon strong evidence. They are so frequently diseased when there is an excess of leucocytes in the blood, that the evidence as to their normal function is of considerable importance.

The opinion that the spleen in the normal state supplies leucocytes rests on the following facts. The round cells which constitute the chief cellular element of the spleen are identical in appearance and size with the colorless corpuscles of the blood. These cells are evidently in rapid process of formation in the spleen, either from pre-existing cells, or, according to Klein's recent researches,[1] from the substance of the protoplasmic layers which limit the splenic and follicular spaces. They do not remain in the spleen, for they are not seen there in health in a state of degeneration, nor does the spleen exhibit that increase in bulk which would result from the retention within it of all the cells which are apparently being formed there. The structure of the organ is such as to facilitate the passage of these cells into the circulating blood. That such passage does occur is proved by the fact that blood which has passed through the spleen contains a much larger number of such cells than the blood which is going to the spleen. The number in the blood of the splenic vein is greater than that of the blood in the splenic artery.[1] On this important point there is a considerable amount of positive evidence. Hirt found the number to be 1 white to 2260 red in the splenic artery, and 1 to 60 in the splenic vein. Funke, Malassez, and Picard, in their careful observations, came to a similar conclusion; but the latter believed that the difference was chiefly observed during digestion.

Other observers, especially Béclard, Lehmann, and Gray, came, however, to a different conclusion, and believed that the proportion of white corpuscles was reduced by the passage of the blood through the spleen. The discord between these observations is not, however, irreconcilable, or incompatible with the assumed function, as will be shown immediately. There is reason also to believe that red blood corpuscles are formed in the spleen. It was maintained, in the last century, by Hewson, and the opinion has been widely accepted by physiologists, that lymphoid corpuscles are converted into red corpuscles in the spleen. It was suggested by Virchow (and also in effect by Bennett) that a large number of the splenic cells, in passing into the blood, undergo immediate development into red corpuscles. Considerable evidence has accumulated in support of this theory. The blood, when it leaves the spleen, is absolutely richer in red corpuscles than the blood which enters the spleen. This was ascertained by Malassez and Picard,[2] who counted the number of corpuscles per cubic millimetre in the blood of the splenic artery and vein respectively. Their numerical observation was corroborated by the fact that the capacity of the blood of the splenic vein for absorbing oxygen was greater than that of the splenic artery. They found also paralysis of the spleen, by section of the nerves, which increases the circulation through

[1] Quarterly Journal of Micros. Science, 1875, p. 363.

[1] Funke, Henle's Zeitschrift, 1851, p. 172, quoted by Bennett.

[2] Comptes Rendues de l'Acad. de Sciences, Aug. 12, 1876.

it, increases the excess of corpuscles and the oxidizability of the splenic venous blood,[1] while the iron in the spleen becomes lessened. Moreover, Funke found in the blood of the splenic vein the same transitional forms which Kolliker noted in the spleen, and also many corpuscles which were smaller and rounder than the others, had less tendency to run together, and resisted water to a greater degree.

It is evident, then, that the number of white corpuscles in the splenic vein will depend not only on the number formed in the spleen and passing into the blood, but on the proportion which is transformed into red corpuscles. Some of the younger lymph cells brought to the spleen by the blood may undergo the same transformation. The proportion of cells thus converted will vary under different conditions and at different times. The greater it is, the smaller will be the proportion of white corpuscles in the splenic vein. Thus the opposing results may be reconciled and harmonized with the other ascertained facts.

Another function has been attributed to the spleen, that of destroying red corpuscles. It is inferred from the occurrence in the spleen of masses of degenerating corpuscles, and from the fact that the spleen contains more iron than corresponds to an equal quantity of blood. The same fact has indirectly been assumed from the circumstance that excision of the spleen commonly causes the bile to be devoid of pigment. It is assumed that the corpuscles destroyed in the spleen furnish the pigment of bile. The conclusion from this fact cannot be admitted to have much weight. The mechanism of their destruction is uncertain. It has been suggested that the lymphoid corpuscles, amœba-like, inclose and destroy them, but Klein concludes, from his researches, that the destruction is effected rather by the inter-cellular splenic protoplasm.

Excision of the spleen has been expected to throw considerable light on its functions, and indirectly on the effects of its disease. The results of the experiment have been, on the whole, disappointing. The clearest fact, one which was established two centuries ago by Oldenburg,[2] and corroborated in the last century by Hewson,[3] is that it is not an organ essential to life or health; that animals which recover from the operation of its removal live on, quite well, without it. Increased appetite has been observed by some experimenters, but it does not appear to be an invariable symptom,[1] and the explanation given of it by Schiff is not very satisfactory. Hypertrophy of the mesenteric glands has been noted after a time,[2] and Ludwig found, in one case, that the enlarged glands possessed a vascular network similar to that of the spleen. Mosler failed, however, to discover anything of the kind, but in the medulla of the bones of a dog, the spleen of which had been extirpated ten months before, Neumann found marked changes, an enormous increase of lymphoid cells and intermediate forms, compared with the normal medulla of the dog, and with that of dogs a few days or weeks after the extirpation of the spleen.

Bardleben noted watery effusion into the cavities, and in Ludwig's case the dog died from hemorrhage. The latter fact suggests an alteration in the blood, and although none was found by Bardleben, the more careful observations of Mosler, by Welcker's method, have shown that the blood, a month after extirpation, was notably paler; the number of white corpuscles was twenty times less than in health; and the red corpuscles much fewer; the diminution continued, being still more marked a few months after extirpation. These facts afford strong corroboration of the function of the spleen in the formation of white and red corpuscles, which has been inferred from microscopical investigations of its normal structure. The application of these facts to the explanation of splenic leucocythæmia will be considered immediately.

Recent observations on the structure and constituents of the medulla of bone, especially those of E. Neumann, afford strong ground for attributing to it a function similar to that of the spleen in the formation of blood. The vascular arrangement of the tissue is peculiar. The transition from capillaries to veins is very gradual, the veins are large in size, and possess very thin walls.[3] It has been said, indeed, by Hoyer,[4] that the blood passes through spaces, devoid of distinct walls, into which the capillaries open, and from which the veins bring the blood. Such a structure could not be observed by other observers. It is clear, however,

[1] This is, as the experimenters note, the reverse effect to that which is obtained with other glands.

[2] Philosophical Trans., vol. ii. 1667, p. 521. Oldenburg excised the spleen of a bitch which afterwards bred.

[3] Med. and Philos. Comment. 1775, vol. iii. p. 87; republished in the Sydenham Society's Edition of Hewson's works.

[1] Mosler, Lussana.

[2] Czermak, Tiedemann and Gmelin, Hyrtl, Ludwig.

[3] E. Neumann, Centralblatt, 1868, p. 885; Archiv. der Heilkunde, 1869, x. p. 68; Hofmann and Langerhans, Virchow's Arch. vol. xlviii. p. 309.

[4] Hoyer, Centralblatt, 1869. Nos. 16 and 17.

that the arrangement of the vessels is such that the passage of the blood through the medulla is slow, just as it is through the spleen. Abundant lymphoid cells exist in the normal medulla, and appear to be in process of multiplication. Numerous cell-forms have been observed, first by Neumann, and afterwards by Bizzozero, Morat, and others, which appear to present every stage of development from lymphoid cells into red blood-corpuscles. The forms correspond closely with the cells from which blood-corpuscles are seen in process of development in the embryo. The nucleus, according to Bizzozero, enlarges, acquires a yellowish red color, and the cell presents the appearance of a red blood-corpuscle surrounded by a thin layer of protoplasm. Within the capillaries may be seen the lymphoid cells, and also the intermediate forms, in large nunbers (Neumann). It is assumed, therefore, that leucocytes are produced outside the vessels, pass into the capillaries, and in the slowly moving blood undergo development into red globules. Bizzozero believes, moreover, that a destruction of red corpuscles also occurs on the medulla.

What are we to conclude is the fate of the pale blood-corpuscles? It appears probable that a few of them persist and perish, as such, in the blood.[1] Many of them pass out of the blood into the tissues, and there subserve processes of growth in a manner at present ill-understood. They also, without doubt, leave the vessels wherever inflammation is going on, and appear in the inflammatory products as pus corpuscles, of which they constitute an important, perhaps the only source. Other white blood-corpuscles probably divide and give rise to similar cells. It is uncertain, however, whether this process goes on outside the lymphatic tissues. Within the glands and follicles of lymphoid tissue, such a multiplication is probably always going on, but it is not yet proved that the lymphoid corpuscles, which have left the lymphoid tissue, and have passed into the blood, undergo such division and multiplication. Lastly, it is now believed that a large number of white corpuscles are transformed into red ones, and that this transformation constitutes the only source of the red globules, and a chief destination of the colorless cells. There is reason to believe that the change takes place mainly in the tissues of certain organs, especially the spleen and the medulla of bone. The precise character of the change which the corpuscles undergo is still a disputed point, and it is not essential for the discussion of the pathology of leucocythæmia.

It was long ago urged by Virchow that all the colorless corpuscles are not capable of this transformation, since some may be seen undergoing fatty degeneration, and others which have suffered such a change that their nucleus is, or can be, broken up, and thus they resemble in all particulars, while circulating in the blood, the characters assumed by those which have passed out of the vessels and are called pus cells. He believed that the transformation occurs only at an early epoch in the development of the cell, before it reaches the circulating blood, and that when it has reached the latter it has become a "simple" not a "specific" cell, and its further transformation into a red globule is impossible. Virchow regarded these colorless corpuscles thus as a "relatively superfluous constituent of the blood, a residuum." We know more now of the purpose served by these corpuscles; that they have a function of great importance by their power of wandering into the tissues. Moreover, there is no additional reason to believe that many circulating corpuscles are not capable of transformation. But, with these reservations, there are additional facts which support Virchow's view, and it is a theory of much importance in connection with the pathology of leucocythæmia.

(3) *The nature of the morbid Change in the Blood, and the relation to it of the pathological Changes in the Tissues.*—The two conditions must be considered to some extent together, and this is especially the case as regards splenic change.

The first question for consideration is, whether the excess of white corpuscles present in the blood in leucocythæmia depends on an increased production, on a diminished transformation into red, or on both these conditions.

It is probable, in the first place, that there is a diminished transformation. Whenever the white corpuscles are increased, the red are diminished in number. The greater the increase in the white, the greater is the decrease in the red. It is, of course, conceivable that this relation might be an indirect one, that the changes which accompany the increase in the white cells might lead to a great destruction of the red. But such continuous destruction of the red could not occur without being revealed by indications which are absent in leucocythæmia. It is therefore certain that, although possibly the destruction of the red globules may be greater than in health, such destruction is not the main cause of the diminution in their number, but that this is chiefly due to a decreased formation. But since, as far as we know, the red glo-

[1] Virchow, in his Archiv, i. p. 144, and p. 593, pointed out that the degeneration they occasionally present is evidence of this.

bules are formed only by the transformation of lymphoid cells, the diminished formation of the red is evidently due to either diminished formation of the lymphoid cells or to their diminished transformation. But the number in the blood is hardly compatible with a diminution in their production, and there must therefore be a defect in the transformation of the cells into red corpuscles.

This view is corroborated by the circumstance that a very large proportion of the pale corpuscles in the blood present degenerative changes which may be considered as incompatible with their further transformation. Some of them are seen to have undergone actual fatty degeneration. In most of the others acetic acid renders a double, tripartite, or horse-shoe nucleus visible (see Fig. 71). It was maintained by Virchow that this effect is to be taken as the result of degeneration of the nucleus and as evidence of the cessation of the active life of the cell. It was long ago pointed out by Donné[1] that these white corpuscles are indistinguishable from pus corpuscles. The discovery of diapedesis renders it probable that they are not only indistinguishable but identical.[2]

Is there an increased formation of leucocytes as well as a diminished metamorphosis? The answer is difficult to give. On the theory of defective transformation of white into red, the blood state may be amply accounted for. Where the disease is manifested only as a change in the blood without any alteration in the structure of the lymphatic organs (as in Dr. Lloyd Robert's case),[3] or such change is trifling (as in the case of Dr. Moxon),[4] it seems to be a sufficient explanation of the condition. But in most cases of leucocythæmia there is an extensive overgrowth of lymphatic tissue, with a corresponding increase in the lymphoid cells contained in the tissue. Taking this overgrowth in connection with the fact of the leucocytal excess in the blood, the conclusion that there is an excessive formation of leucocytes has usually been accepted as a necessary one.

The problem is in some respects a simpler one as regards the lymphatic glands than as regards the spleen. In the rare cases in which the lymphatic glands are the seat of simple soft enlargement, due to an excessive quantity of tissue differing but slightly from the normal tissue of the glands, and in which the blood contains a considerable excess of colorless corpuscles resembling the cells of the enlarged glands in every particular, the evidence is very strong in favor of an increased formation and increased supply to the blood from the diseased glands. Even here the possibility of diminished transformation cannot, by any facts at present at our disposal, be entirely excluded. It is, as just remarked, possible that the young lymphatic cells, after reaching the blood, may, in it, or in certain organs, as the spleen and marrow, undergo the transformation into red globules. That this is the case is probable from the fact that a diminution in the number of red globules accompanies glandular diseases in which, apparently, the supply of cells to the blood is arrested by changes in the structure of the glands. But, on the other hand, a leucocythæmia may sometimes result from a local growth, and may be out of proportion to the anæmia, as in the case of Lücke's, and in one under my own observation, in which seventy white corpuscles were present in every field of blood, from a patient with a local cervical lymphadenoma. This is evidence that, under some circumstances at least, the supply to the blood from the lymphatic glands is increased, and renders it probable that in soft glandular enlargements, in which a path to the blood is demonstrable by injection, this is often the case.

Regarding the spleen, the problem is more complex. The spleen in leucocythæmia undergoes great enlargement, which is due, mainly, to an increase in the splenic pulp. The splenic follicles consist of adenoid tissue with large numbers of lymphoid cells in process of formation, and it is believed that these cells, formed in the follicles, pass from them into the meshes of the splenic pulp (where, perhaps, other similar cells are formed), and are there transformed into red corpuscles and added to the blood. The splenic pulp in leucocythæmia is increased in quantity, apparently by the growth of the lymphoid tissue in it. There is an enormous increase in the lymphoid corpuscles which it contains. This increase has suggested to most pathologists the occurrence of a rapid formation of corpuscles in it. But the suggestion occurs, Is not

[1] Cours de Microscopie, 1844, p. 196.

[2] Vidal, in his conclusions (De la Leucocythémie Splenique, Gaz. Hebd. 1856, p. 253) regarding the relation of white corpuscles and pus cells, certainly anticipated more recent views. "Les globules blancs de sang, les globules de pus, de mucus, ne sont qu'une même espèce de globules: Ce qu'on a décrit comme globule de pus et du mucus n'est pas autre chose que le globule blanc de sang; ainsi les globules blancs du sang seraient un des elements constitutifs du pus, ce qui nous rapprocherait de l'opinion des anciens sur la question de la pyogénie; et nous ne serions pas etonné si le microscope venait demontrer un jour que tous les elements du pus son des elements homœomorphes, contrairement à la doctrine le plus généralement accepté à notre epoque."

[3] Brit. Med. Journal, Nov. 27, 1869.

[4] Clin. Soc. Trans. 1877.

the pathological condition accounted for by the mere retention in the splenic pulp of large numbers of white corpuscles? That such retention and accumulation does actually occur, can hardly be doubted. It must be the chief process in anæmia splenica, in which there is a simple "hypertrophy" of the spleen similar to that which occurs in leucocythæmia, a great deficiency of red corpuscles in the blood, but no excess of white, although numbers of similar cells are collected in the splenic pulp. But such accumulation cannot, in the spleen of either anæmia or leucocythæmia, be the whole process. The enormous increase in the bulk of the spleen, sometimes amounting to fifty times the normal, is due, not to mere accumulation of lymphoid cells, but to an overgrowth of connective tissue-elements and trabeculæ, as well as lymphoid cells. The duration of these splenic enlargements, the absence of degeneration in them, and the fact that they always contain an abundance of young lymphoid cells, is proof that a new formation of such cells, proportioned in degree to the enlargement of the organ, is constantly going on.

What determines the retention of the cells in the spleen, or permits their passage into the blood, is still unknown. It does not depend on the size of the organ. There is no relation between the size of the spleen and the degree of leucocythæmia. In some of the cases in which the spleen was largest, the excess of white corpuscles has been moderate. Nor does it apparently depend on the conditions of the origin of the enlargement. It may be due to peculiarities in structure, as an increased stroma, such as can be recognized in some lymphatic glands, inclosing and retaining the corpuscles, but such peculiarities in structure have hitherto escaped detection in the spleen. It does not indeed appear to be a persistent condition, since the effect is often observed to vary. An enlarged spleen may at one time be accompanied by no excess of white corpuscles in the blood, at another time by a great excess. But it appears that when such a change occurs, there is, in most cases at least, a progressive enlargement of the spleen, and it may be that a certain degree of accumulation leads to an overflow, that in the process of overgrowth there occurs such a change in the relation of the newly-formed cells to the tissue as permits their passage into the circulating blood. The contraction of the normal spleen has been found by Bulgak to increase the proportion of white corpuscles in the splenic vein, and the same result has been found to occur with the simple chronic malarial tumor.

From the foregoing considerations, it appears probable that imperfect metamorphosis of white into red corpuscles is an important, and in some cases the chief, element in the morbid process of leucocythæmia. To what is this defective transformation to be ascribed? The metamorphosis may be part of the process of growth of the corpuscle, or it may be due to the influence upon it of its environment. There is not much evidence to show on which of these it actually depends, but either hypothesis affords a ready explanation of the phenomena of splenic leucocythæmia. First, the change may depend on the property of the corpuscle; a certain growing leucocyte may, in its growth, and by virtue of the tendency of development which it possesses, undergo the changes by which it gives rise to a red globule. Although the splenic pulp in leucocythæmia bears such a resemblance in characters to the normal pulp that it has always been spoken of as "hypertrophy," the changes in it must be considerable. It is firmer than normal, and paler; there is a larger amount of connective tissue in it. This difference involves the assumption of a difference in the growth and development of the tissue elements of which it consists. The splenic corpuscles under consideration must participate in the change, especially if, as Klein believes, they are derived directly from the protoplasm of the stroma. Their tendency of development may be so affected that they no longer change to red globules, but remain as lymphoid cells, and in the blood persist as white blood corpuscles. The second hypothesis is that the leucocytes undergo their peculiar transformation in certain organs, under some influence, perhaps chemical, exerted upon them by the constituents of those organs. There is reason to believe that the change occurs in the spleen and medulla of bone to a greater extent than in the blood, since intermediate forms are found more abundantly in those organs than in the blood at large. Corpuscles which come from the lymphatics, must, if transformed at all, be transformed after entering the blood, and that they are so changed is probable from the profound anæmia induced by general disease of the glands, unattended by splenic change. That the vital properties of the corpuscles, their tendencies of development, are changed by environment, is probable from the fact that white corpuscles which have left the blood, and escaped as pus, rapidly present evidences of degeneration and never of metamorphosis into a red globule. If this metamorphosis depends on the influence exerted on the corpuscles by certain organs, or by the blood, that influence may be so changed by disease of those organs, or by a morbid state of the blood, that the metamorphosis is hindered, is attained by but few corpuscles,

and hence there result a progressive deficiency of red and an excess of white corpuscles.

It has been urged that this defective transformation, due to a change in the blood, constitutes the whole initial lesion in leucocythæmia; that the splenic enlargement is due only to the accumulation within it of leucocytes, which from defective transformation, exist in large quantities in the blood, and are arrested in the splenic tissue. This view was originally suggested by Griesinger[1] and it has been adopted by Cayley, Kottmann, Colin, and others, and has been recently urged by Biesiadecki, who bases it on the following considerations: (1) that the anatomical change in the spleen does not suggest any excess of formation; (2) that there is an atrophy, instead of an hypertrophy, of the parenchyma of the organ, the chief change being an accumulation of cells in the perivascular tissue, in which he has found pigment massed in the melanotic spleen of ague; (3) that the corpuscles present degenerative changes which show that no further transformation can take place; and (4) that the absence of any ill-effects in extirpation of the spleen is hardly compatible with the view which leucocythæmia suggests of its functional importance as a blood-making organ. That an essential condition in leucocythæmia is defective transformation of white into red, that such defective transformation may be the only morbid condition in some cases, and that such accumulation in the spleen may occur, has been urged in the preceding pages, and was, in effect, suggested long ago by Virchow. But the enlargement of the spleen in leucocythæmia can scarcely be explained by the accumulation within it of cells brought by the blood. Many cases are on record which show that a splenic enlargement may precede any excess of leucocytes in the blood,[2] and make it probable that this is, in most cases, the order of events. The most distinct causal influence (ague) is one which acts directly on the spleen, and further, a primary lesion of the spleen, caused by section of its nerves, may produce a considerable excess of leucocytes in the blood.[3] The view that there is an atrophy of the splenic tissue is not in harmony with the conclusion of most pathologists, who have uniformly asserted that the splenic follicles become indistinct, but the tissue elements of the pulp undergo a vast increase and cause the enlargement of the organ. With this my own observations entirely accord. Were there only an accumulation within the capsule of the spleen of fifty times the weight of leucocytes, it is needless to say that no splenic tissue or consistence would be recognizable. Moreover, there is evidence that other lymphatic tissues may participate in the initial change and even be alone affected. Lastly, the effects of excision of an organ are of no value as evidence of the effects of its disordered function. A lost influence may be replaced by that of other organs, while the excess or perversion of it may entail grave and enduring consequences.

The relation to the blood state of the changes in the other lymphatic tissues and in the organs must be considered in further detail.

Glands.—The glandular changes in leucocythæmia must be regarded in a somewhat different light, according as they occur at the beginning of, or late in the course of, the disease. In the rare cases in which simultaneous enlargement of the glands and the spleen occurs, and in which the spleen is changed as in primary splenic leucocythæmia, the glands are the seat of a primary lymphatic overgrowth, which may precede the development of the hæmic change to which it probably in some degree contributes. These cases are intermediate between splenic leucocythæmia and lymphadenosis, or, rather, present a combination of the two morbid states, and belong in their pathology to both. Their aspect, as they relate to the lymphatic glands, will be considered more fully in the next article. It may be here mentioned, however, that they afford distinct evidence of the origin of the disease in an affection of the lymphatic tissues and not of the blood.

In another set of cases the glandular enlargement occurs late in the disease, after the leucocythæmic state has been developed, and has existed for some time. Two views have been held regarding the pathology of this condition. Virchow regarded it as a lymphoid growth, analogous to that which sometimes initiates the disease, but occurring secondarily to the splenic affection, and indicating a stage of generalization of the disease. It has, on the other hand, been urged originally by Dr. Wilks, that such gland changes are due simply to the accumulation in the glands of leucocytes brought to them by the circulating blood, or, according to Dr. Moxon, brought from the tissues by the lymphatics. But this theory rests upon no direct evidence, and is opposed by certain facts. In the first place, there is no relation between the occurrence of these glandular changes and the degree of leucocythæmia. If the theory were true, the greater the leucocytal

[1] Virchow's Archiv, Bd. v. p. 391.

[2] Two cases are recorded by Bennett, Leucocythæmia, p. 128, Case 36; and Day, Clinical Histories and Commentaries.

[3] Von Tarchanoff, Pflüger's Archiv, 1874, Bd. viii. p. 97.

excess, the more constantly should glandular enlargements occur, and the greater should be their degree. But no such relation can be observed. Many of the cases in which the excess of white corpuscles was extreme, and in which even growths existed in the organs, presented no glandular enlargement; while in others, in which the glands were affected, the excess of leucocytes was comparatively slight, and the glandular enlargement occurred early in the disease. The independence of the two conditions goes further, since the glands may be the seat of general enlargement with an overgrowth of splenic pulp, without any excess of leucocytes in the blood.[1] Thus the circumstances suggest strongly that the glandular affection and blood change are, at least to a large extent, independent, and that the glandular affection depends, as Virchow supposed, on a lymphatic growth. The same opinion is suggested by the microscopical structure of the enlarged glands. When soft, as they commonly are, they present large quantities of lymphoid cells, but these are, as a rule, smaller than those of the spleen. Moreover, there may be an increase in the retiform tissue as well as of the cells, so that the gland may have a tolerably firm consistence. It is not denied that some accumulation of cells may take place, but it does not seem probable that the enlargement is primarily or mainly due to such accumulation.

Medulla of Bone.—The frequency with which the bone-changes, already described, are met with in cases of leucocythæmia, shows that the association cannot be an accidental one. The evidence, already mentioned, that this structure has a blood-forming function, led Neumann to compare the disease of the medulla to that of the spleen. Further observations have shown that the change may, with greater accuracy, be compared to that in the lymphatic glands. It seems to occur, usually, as a secondary affection, late in the case. The great increase in the number of lymphoid cells, and the resulting changes in structure, are comparable to the changes in the lymphatic glands. Like the latter, also, the medullary change bears no relation to the amount of blood-change, or to the degree of splenic enlargement, and may occur without any excess of leucocytes in the blood (in lymphadenosis and pernicious anæmia), and be absent when there is extreme leucocythæmia. The same opinions have been expressed regarding its nature. It has been looked upon by Neumann, Mosler, &c., as an independent lymphatic overgrowth, with the same effects upon the blood. By others, as by Dr. Moxon, it has been regarded as a purely secondary change, the consequence of the accumulation within the structure of leucocytes brought to it by the blood. The correctness of the latter view may be doubted from the apparent independence of the marrow changes and leucocytal excess, in occurrence and degree. It is probable, therefore, that it depends on a simultaneous lymphatic overgrowth.

There is some reason to believe that this change may be the primary alteration in leucocythæmia. Thus in a case recorded by Mosler,[1] in which leucocythæmia was associated with much enlargement of the spleen, there was an extreme alteration of the medulla, the iliac bone, ribs, and especially the sternum, being much swollen and soft. Sternal pain preceded for four years the first symptoms which could be attributed to the splenic enlargement. It has even been thought that there may be a pure myelogenic form of leucocythæmia, a general bone change being the only pathological alteration. The evidence is at present insufficient to establish this, but there are facts which show that a primary bone disease may be associated with an excess of pale corpuscles in the blood. In a case recorded by Waldeyer[2] (on which, perhaps, undue stress has been laid as evidence of a purely myelogenic form of leucocythæmia), a local osteomyelitis of one tibia, followed by pyæmia, was associated with such an excess of leucocytes in the blood, that 150 were present in the field of the microscope. But the spleen was enlarged to eight and a half inches in length (partly from embolism), and the right iliac glands and the intestinal glands were also somewhat enlarged. A case in which an osteomyelitis, following an amputation of the thigh, was associated with a large excess of pale corpuscles in the blood, was recorded by Mursick.[3] Moreover, a local growth in bone seems capable of entailing a state of leucocythæmia just as did an axillary lymphadenoma in the case described by Lücke.[4] Heschl recorded a case in which a mass of growth in the femur, the size of a child's head, apparently arising in consequence of a blow, was associated with enlargement of the inguinal and mesenteric glands, and a great excess of leucocyte-like cells in the blood. The clots in the heart were grayish-red, and in some blood from a small vein the proportion of white to red corpuscles was estimated with the microscope to be as one to three.[5]

[1] For examples of this see the next article.

[1] Berlinl. Kl. Wochenschrift, 1876, pp. 49–51.

[2] Virchow's Archiv, Bd. lii.

[3] New York Med. Record, 1868, March.

[4] Virchow's Archiv, vol. xxxv. 1866, p. 524.

[5] Virchow's Archiv, 1855, vol. viii. p. 355.

Intestinal Changes.—The enlargement of the lymphatic follicles of the intestine occurs, as a rule, late in the disease, and has been regarded as part of the generalization of the affection. The increase is due, in most cases at least, to an additional lymphoid growth, often extending far beyond the original limits of the follicle. These growths occur, as does the enlargement of the lymphatic glands, independently of the degree of leucocythæmia, and independently even of its existence. They are seen, for instance, in lymphadenosis; and Cohnheim has described[1] a remarkable case in which the spleen was enlarged as in leucocythæmia, the intestinal follicles were enlarged, and minute lymphoid growths existed in various organs, without any excess of white corpuscles in the blood. It is clear, therefore, that the intestinal change cannot be due wholly to the excess of leucocytes, as has been asserted. It is, of course, possible that the excess may increase the follicular growth, although there is not at present any direct evidence to show that such is the case.

The intestinal growth may supply white corpuscles to the blood and increase the degree of leucocythæmia. It has been thought that it may even be alóne a source of a large excess, as in a case recorded by Behier, as "intestinal leucocythæmia."[2] The patient was a man, aged 25, who suffered from weakness, pallor, dyspnœa, and the blood presented an equal number of white and red corpuscles. Post-mortem, the spleen was scarcely enlarged, the glands everywhere normal, and Peyer's patches were so thickened as to project three millimetres above the surface of the intestine. A somewhat analogous case in a child has been described by Virchow.[3]

Visceral Changes.—The pathology of the other visceral changes in leucocythæmia has received a different explanation in different cases. The occurrence of aggregations of lymphoid cells, among which, in some instances, a distinct stroma of retiform tissue could be traced, led Virchow to regard them as lymphatic growths, arising in the lymphatic interstices of the tissues and organs, and an indication of the generalization of the disease. In other cases, the conspicuous distension of the capillaries with white blood-corpuscles, and the occurrence of aggregations of white corpuscles in the immediate vicinity of vessels, has suggested the explanation that these are merely local aggregations of extravasated leucocytes, escaped from the vessels by rupture or diapedesis.

It can scarcely be doubted that each of these views is true, and that the organic changes have this double origin. The lymphatic structure of some of the new formations is very distinct, and the stroma evidently different from that of the organ in which they occur. The size they occasionally attain precludes any explanation but that of a process of growth. On the other hand, the obstruction of capillaries by leucocytes is often very distinct, and the position of aggregations of leucocytes adjacent to the vessels renders the view that they have escaped at the spot a probable one. The extent to which the two processes of growth and extravasation are combined to produce the pathological changes probably varies in different cases, and some morbid appearances may be interpreted almost as well on either theory.

Two circumstances must ever be borne in mind in drawing any conclusion from the position or characters of an apparent growth or extravasation. First, that the vicinity of vessels is that in which the lymphatic tissue is most highly developed and in which other lymphoid growths, by preference, occur. The position on a vessel must not, therefore, be taken as conclusive proof of origin by extravasation. Secondly, it is by no means improbable that an extravasation of leucocytes, or an aggregation of wandering leucocytes, may constitute the nucleus of a lymphoid growth. The cells may possess, in the constitutional state, a somewhat infective property, by which they may multiply, and induce the development of a stroma of retiform tissue, in their points of aggregation. By a similar means, lymphoid growths in progress may be reinforced. This is the theory of Virchow. If it be true, it has been thought that leucocythæmia might be communicable by inoculation. Mosler has failed to produce the disease by the injection of leucocythæmic blood.

The probable origin of the various symptoms of leucocythæmia has been considered, as far as our knowledge extends, in the description of those symptoms.

Relation to Anæmia Splenica.—The relation of splenic leucocythæmia to splenic anæmia has been incidentally discussed in the consideration of the origin of the excess of pale corpuscles. The passage of the corpuscles into the blood, or their retention where formed, is the only difference which a pathological scrutiny can suggest. It is possible that in the anæmic form the production of leucocytes is less than in the leucocythæmic form, and that an increased formation, or an accumulation out of proportion to the amount of stroma, may constitute the transition of the one form into the other—a transition

[1] Virchow's Arch., vol. xxxiii. 1865, p. 451.
[2] L'Union Médicale, August, 1869, Nos. 99 and 100.
[3] Gesammt. Abhand. p. 199.

which sometimes occurs early and sometimes late in the course of the disease. It is remarkable how closely the pathological changes and even the symptoms of leucocythæmia are paralleled by the cases of simple splenic anæmia. In Cohnheim's case, already mentioned, the remarkable growths in glands, liver, spleen, kidneys, tonsils, and intestines were all secondary in time to a splenic enlargement, and the patient had had ague two years before. In two other cases, one with a glandular enlargement and the other with enlargement of the liver, there was similar evidence of paludal poison. The symptoms present many similar features, and the tendency to hemorrhage may be marked as in leucocythæmia. In Cohnheim's case there was daily epistaxis; and in a case recorded by Lissauer,[1] excessive hemorrhage on the extraction of a tooth was the first symptom. It is only by the secondary consequences of the leucocytal excess that the morbid states can be separated in their symptoms.

(4) *The relation of the morbid process to the causes of the disease.*—Of the relation of leucocythæmia to its ultimate causes we know very little. It is only by the study of cases early in their course that more can be learned on this point. The causes to which a relation can be most clearly traced, appear to act primarily on the lymphatic organs, in which the chief anatomical changes are found. Intermittent fever, for instance, leads to acute and chronic enlargement of the spleen, and this precedes the change in the blood. The mechanism by which the enlargement of the spleen is produced is unknown. It appears, however, that the acute enlargement is attended with a diminished supply of white corpuscles to the blood, *i. e.*, an arrest of their formation, or a retention of those formed within the spleen: probably the latter. In the early acute enlargement there is a great increase of the amount of blood in the spleen. There must, therefore, be a vaso-motor paralysis. But simple paralysis of the spleen leads to an increased production, and an increased supply to the blood, of splenic cells. Von Tarchanoff[2] found that the division of the splenic nerves caused enlargement which was accompanied by the presence of from 40 to 70 white corpuscles in each field on the second and fourth day, instead of the normal 10 to 15. The excess and the splenic tumor lessened together. In the congestion of intermittent, it would seem that whether there is or is not an increased formation of leucocytes, there is a diminished supply to the blood. This number is smaller than normal during intermittent, and in cases of cachexia with simple splenic enlargement.[1] The retention of the cells probably gives rise to the persistent enlargement which occurs in many cases, and, at least in part, to the anæmia which results. The passage of some of these cells into the blood in undue quantity appears to be one element in the origin of leucocythæmia.

But intermittents exercise an influence on another blood-forming structure, the marrow of bones. Browicz[2] has found that after repeated intermittent the marrow loses much of its fat, and the tissue assumes an embryonal character. Round, nucleated cells replace the fat cells, and pigment accumulates in its structure.

The blood itself is apparently directly affected. In recent cases it contains a large quantity of free pigment. After a time, the pigment disappears from the circulating blood and accumulates in certain organs; in the splenic parenchyma (not in the splenic follicles), in the medulla, and in the interacinal tissue of the liver. The pigment is supposed to arise from the destruction of red blood-corpuscles.

Another important relation of leucocythæmia is to the puerperal state. In several cases the association has appeared clear. It derives significance from the fact that during pregnancy, and especially after delivery, there may be a marked tendency to the occurrence of lymphatic changes. During pregnancy, there may be, as will be mentioned presently, an excess of leucocytes in the blood, and in febrile attacks after delivery, the excess may be very great. Some remarkable cases are on record in which, after delivery, an acute swelling of spleen and glands, originating then, or during the preceding pregnancy, was accompanied by leucocythæmia, and ran a rapid and fatal course.[3] Of the possible mechanism of these relations we are still ignorant.

In other cases in which no etiological relation could be traced, we must assume the existence of a primary change in the lymphatic tissues, especially in the spleen. Why, in some cases the glands, in others the spleen, in others both, should be affected, we have no evidence. It is probable that the spleen is the seat of more frequent and considerable variations in its vascular state, due to the influence on it of the state of the alimentary canal, than any other collection of lymphatic tissue, and that the variations may lead to irritative changes, initiating those which, in a certain constitutional state, result in leucocythæmia. The existence

[1] Berlin Kl. Wochenschrift, 1865, ii. p. 403.
[2] Pflüger's Arch. 1874.

[1] Kelsch, Arch. de Physiologie, 1876, p. 490.
[2] Virchow's Jahresbericht, 1876, i. 275.
[3] Paterson, Edin. Med. Journal, June, 1870.

of a widely spread predisposition in some cases, is seen in the simultaneous affection of spleen and glands. In an instructive case recorded by Vogel,[1] there was evidence of this double predisposition, leading, under irritation, to a transient glandular and persistent splenic enlargement. Glandular swellings in the neck and groin preceded the splenic enlargement. The former seemed to be due to an angina. They subsided; then the spleen enlarged, then the cervical glands again enlarged, and suppurated and healed, but the splenic enlargement persisted.

(5) *The origin of the Variations in Symptoms.*—There are many characters of leucocythæmia which we are at present unable satisfactorily to explain. One of these is the remarkable variation in the symptoms, blood-state and splenic and glandular enlargements, which some cases present. The variation in the number of white corpuscles in the blood is occasionally very great. It may be in part due to variations in the number of white corpuscles which undergo transformation into red. It is probable that the metamorphosis is largely influenced by the varying general condition of vitality. This may be one explanation of the excess occasionally observed in acute febrile diseases. The variations in the pyrexia and general state in leucocythæmia may well be attended with a similar result. It is probable, again, that a contraction of the spleen, by whatever induced, may be accompanied by an expulsion of corpuscles into the blood. This has been established with regard to the normal spleen and the enlarged spleen of malaria. In leucocythæmia, the variations in the size of the spleen are of frequent occurrence, and may induce consequent variations in the state of the blood. Hemorrhage again, which, in the normal state, causes a temporary increase in the number of pale corpuscles, may have a similar effect in leucocythæmia. A large hemorrhage, external or internal, which lessens very much the volume of the blood, may cause a remarkable diminution in the size of the spleen.[2]

A sudden increase in a local growth may be attended by a great diminution in the degree of leucocythæmia, and even in the size of the spleen and lymphatic glands. Cases illustrating this have been recorded by Mosler[3] and Shingleton Smith.[4] The explanation probably is that such growth is due, in part at least, to a vast accumulation within it of the circulating leucocytes, sufficient to relieve the blood and drain the spleen and glands.

The rapidity with which great changes in the state of the blood may occur is very remarkable. This is seen in some cases which cannot be regarded as splenic leucocythæmia. Litten[1] has described a case of acute anæmia of three weeks' duration, in an intemperate man, in whom, till within the last four days of life, there was no marked increase in the number of white corpuscles, and during that time the increase was so rapid that on the day of death the proportion of white to red was as one to four. A case in which there was almost constant permanent excess and still more rapid and remarkable variation, has been published by Dr. Goodhart.[2] Within a day or two, the blood-state varied from no excess of white to almost equal numbers of white and red, and the variation recurred every few days. At the post-mortem, in which simple enlargement of the spleen to 17 oz., glandular enlargement, and lymphoid growths in liver and kidneys were found, nothing was discovered to explain the alternation. Remarkable variations in the number were present in a case described by Dr. Day as "alternating leucocythæmia," but it is probable that in this case they must be ascribed in part, if not entirely, to the frequent hemorrhage, and the case can scarcely be classed with those of splenic leucocythæmia.

(6) *The occurrence of Leucocytal Excess in other diseases.*—In many morbid states an excess of leucocytes may be present in the blood. The number may vary from the normal two or three, per quarter-inch field of the microscope, to ten, twenty, thirty, or fifty, but rarely exceeds the latter in any but splenic diseases.

Hemorrhages may cause a temporary increase in the proportion of leucocytes in the circulating blood. The first effect of a hemorrhage is, of course, to diminish the corpuscles and the serum, in proportion to one another. It has been found by Mr. W. S. Tuke, in some observations he has kindly made for me with the hæmacytometer, that, in man, immediately after a venesection, the blood exhibits nearly the same number of white and red corpuscles as existed before the operation. There is, however, a rapid passage of liquid from the tissues to the blood, and hence the number of corpuscles per cubic millimetre of blood rapidly falls and attains its minimum usually from half an hour to an hour after the hemorrhage. It then begins to rise, apparently from an increased supply of cells to the blood. The rise is often accompanied by a considerable excess of

[1] Virch. Arch. Bd. iii.
[2] Vidal, Gaz. Hebd. 1859, p. 167.
[3] Berl. Klin. Wochenschrift, 1876, No. 49.
[4] British Med. Journal, 1874, Nov. 21.

[1] Berl. Klin. Wochenschrift, 1877, p. 19.
[2] Clin. Soc. Trans. 1877, p. 57.

pale corpuscles, which is the greater, the larger the hemorrhage,—is greater in certain constitutional conditions than in others, and is far greater in some animals than in man. In the horse, for instance, it is said that the numbers of red and white cells may be rendered equal by a large hemorrhage. There is little or no evidence as to the mechanism by which this is effected. Probably the defective number of corpuscles may lead to the rapid passage of leucocytes into the blood, and their removal into the circulation before their metamorphosis into red ones; and the excess may disappear from the gradual conversion of these cells into red globules. It is not difficult to understand that loss of blood may lead to the passage of pale cells into the blood in large numbers, since the diminution in the size of the spleen from a diminution in the amount of blood in it, may lead, by the contraction of its elastic capsule, to the expulsion of free leucocytes from the meshes of the splenic tissue and follicles, an effect analogous to that which is produced when contraction is caused by the application of electricity.

Suppuration appears to exercise a remarkable influence on the number of white corpuscles. This was first noted by Griesinger. During the process of suppuration, probably when a collection of pus is retained in the body, a remarkable number of leucocytes has been observed in the blood, disappearing when the pus escapes.[1] A case lately occurred in University College Hospital,[2] in which the blood of a patient recovering from perityphlitis, contained as many as 150 white corpuscles in a not over-crowded field: a few days afterwards a large abscess pointed in the back. The corpuscles, after the opening of the abscess, rapidly diminished in number and soon reached the normal. There was no enlargement of spleen or lymphatic glands. Apolant,[3] has observed, in a child four months old, with a large number of suppurating abscesses, that the white corpuscles were to the red as one to twenty, and that after the suppuration had for the most part ceased, they were as one to three hundred. A slighter excess, twenty to thirty in the quarter-inch field, may often be seen under similar circumstances, and I have observed in some cases that the majority of these corpuscles present fatty degeneration. This suggests that probably the excess may be due to the return of the leucocytes (or pus cells) into the vessels. A similar effect has been observed to follow the application of a blister. Septicæmia may also be accompanied by a considerable increase of leucocytes in the blood.

Local growths, composed of small cells resembling, in size and appearance, white blood-corpuscles, may be accompanied by a considerable excess of cells in the blood identical in appearance with the colorless corpuscles. In a case lately under my own observation of a large ulcerating lymphadenoma of the cervical glands without evidence of general gland disease, fifty to seventy colorless corpuscles were present in every field of the microscope. The case of Lücke's has been already referred to, in which, with a lymphadenoma of the axillary glands, the number of colorless and colored corpuscles in the blood was equal. In cancer there may be a remarkable excess, as in a case recorded long ago by Dr. Fuller.[1] I have seen as many as seventy white corpuscles in a one-fifth inch field, in a case of cancer of the liver.

Pregnancy, &c.—A slight excess of leucocytes is common in the blood of pregnant women; the increase is, however, rarely considerable. The proportion of white to red has been carefully estimated for me in a series of cases by Dr. R. S. Miller. Seven were multiparæ and four primiparæ. The proportions were as follow:—

MULTIPARÆ.

Proportion of white to red.	Age.	Month of pregnancy.
1—404	20	9th
1—400	28	8th
1—366	31	8th
1—360	37	7th
1—320	32	?
1—290	22	6th
1—213	27	6th

PRIMIPARÆ.

1—261	24	6th
1—200	20	8th
1—180	18	9th
1—130	17	7th

These results suggest that the increase is greater in primiparæ, and is greater the younger the individual.

A more considerable increase has been noted by Malassez[2] a few hours after delivery. Certain puerperal diseases may be attended with a great excess of white corpuscles, as was pointed out in 1844 by Bouchut, who regarded them as pus cells. Malassez observed an increase in fatal cases of puerperal septicæmia, amounting once to one white to fifty-four red. Schulten has recorded cases[3] in which, during an irregular febrile attack which com-

[1] Several observations of this character are published by Bonne. Variation du nombre des globules blancs du sang dans quelques maladies. Paris, 1876.

[2] Lancet, 1876, ii. p. 253.

[3] Virchow's Archiv, Bd. lix. p. 302.

[1] Path. Trans. vol. ii. p. 224.

[2] Bull. de la Soc. Anatom. 1873.

[3] Virchow's Archiv, Bd. xiv. p. 505.

menced three days after delivery, there was a large excess of white corpuscles of various sizes, the proportion rising to one white to ten red. The normal state was regained when the fever subsided.

Many acute diseases are attended with the presence of an excess of pale corpuscles in the blood, an excess which is both relative and absolute. The excess does not bear any relation to the pyrexia, but seems related rather to the tissue changes which occur in the disease; and it is especially marked in those diseases which are accompanied with suppuration or with acute glandular swellings.

In typhoid fever, a marked excess has been noted by many observers.[1] Bonne states that it precedes ulceration, and disappears when this has been established. The maximum observed by him was 62,000 per cubic millimetre, an increase to four times the normal quantity. In relapsing fever an excess was observed by Allen Thomson[2] and others, and by Wilks in typhus fever. In erysipelas and pneumonia, a marked excess has also been observed.

In glanders, a great increase is commonly present. This was pointed out by Delafond twenty years ago, and more recently by Christot and Kiener,[3] who found the increase occasionally amounted to the proportion of one white to six red.

In scarlet fever, a considerable increase was noted about the seventh day by Bonne, amounting in one case to 210,000 per cubic millimetre (about twelve times the normal). In diphtheria, also, an excess was found in a large number of cases by Bouchut. In variola, a marked increase was found by Dūroziez and Brouardel, and it has been shown that this increase precedes the formation of pus in the eruption. Lambert found that in one case, on the third day of the eruption, the white corpuscles amounted to 10,000 per cubic millimetre, and that on the fourth day it had risen to 93,000, and on the fifth had fallen again to 30,000.[4]

In tuberculosis, a slight excess was found by Duroziez; in several cases fifteen, and in one forty, white corpuscles were seen in the field of the microscope. The occurrence of an excess of pale corpuscles in the blood in inflammatory affections of bone has been already mentioned.

Leucocythæmia in Animals. — In the domestic animals leucocythæmia may present precisely the same symptoms as in man. The cases have been carefully studied by Prof. Böllinger,[1] of Zurich, who has recorded several cases in the dog; and other cases have been met with in the pig, the cat, the horse, and the guinea-pig. The spleen has been in some cases affected alone; in others, the lymphatic glands have also been involved. The marrow of bones has also been observed to be changed. Most cases present secondary changes in the liver, kidney, or lung, and the same tendency to hemorrhage has been present as is seen in man. Inoculation experiments failed.

Diagnosis. — The recognition of developed splenic leucocythæmia is a matter of no difficulty. The general appearance of the patient is that of one suffering from a cachectic disorder; the abdominal trouble is sufficiently pronounced to attract attention; a drop of blood drawn from the finger is strikingly pale, and placed under the microscope is seen to contain so many white corpuscles that, at first sight, it may appear to consist chiefly of them. But in the early stage the disease is much less easy to recognize, and its diagnosis must, in some cases, be allowed for a time to remain in doubt. The line of demarcation proposed by Magnus Huss, that the proportion of one in twenty is necessary to render a case one of leucocythæmia, is of limited application. It is only when the excess reaches this degree that the nature of the case can be pronounced with certainty. But in the early stage of every case there is a period in which the proportion is less than this. It is precisely in these early stages that the recognition of the disease is of the greatest practical importance, for it is then only that permanent good can be expected from treatment. The points on which the diagnosis must turn in these cases of commencing leucocythæmia are the recognition of a progressive increase in the white corpuscles of the blood, associated with a distinct enlargement of the spleen. The determination of the degree of blood change is, therefore, a matter of great importance.

The fact of an excess of pale corpuscles, and its degree, are usually determined by observing the number of such corpuscles in the field of the microscope. This is a rough method of very inexact character, and liable to many fallacies. The significance of the number will depend on the amount of blood in the field, *i. e.*, on the size of the field and the depth of the film of blood observed. The size of the field varies with every microscope and with every lens. The thickness of the film varies with the size of the drop and the

[1] Virchow, Bourdon, Jaccoud, Golgi, Bonne.

[2] Cormack, Nat. Hist. of the Epidemic Fever. Lond. 1843, p. 113. They were regarded as pus cells.

[3] Compte Rendue de l'Acad. des Sciences for Nov. 23, 1868.

[4] Quoted by Bonne. Lymphoid growths closely resembling those of leucocythæmia were found in a case of variola by Wagner in liver and spleen.

[1] Virchow's Archiv, Bd. lix. Heft 3 and 4. 1874.

weight of the covering glass. The only method of ascertaining the degree with accuracy is to count the numbers of red and white. This may be done absolutely, in a manner to be described directly, or relatively, by counting the numbers in a field or a series of fields. From the manner in which the corpuscles run together into rouleaux and masses, it is extremely difficult to count them in the blood as drawn. In order to do this accurately, it is necessary to prevent the red globules running together by diluting the blood with water, or better, with a one per cent. solution of common salt. A small quantity of solution, two or three times the volume of the blood, is sufficient. The separated red and white globules can then be counted. The operation may be facilitated by the employment of a stage micrometer, or a "quadrilled ocular," *i. e.*, an eye-piece micrometer ruled in squares; so that the field is divided into smaller areas. In order to obtain an accurate result at least as many corpuscles should be counted as will give one hundred white ones.

This relative proportion of white and red corpuscles is of great practical importance, since the two are, as has been seen, mutually related. But it is also important to know the actual alteration this represents, *i. e.*, what is the absolute number of white and red corpuscles in a given volume of blood. The determination of this point is of importance in prognosis as well as in diagnosis. The diminution of red corpuscles in leucocythæmia may reach a point equalled in no other disease, and on this diminution many of the consequences depend. It is evident, therefore, that to ascertain the degree and the course of the anæmia is of as much importance as to ascertain the degree and course of the leucocythæmia. The relative enumeration gives also little information concerning the absolute increase of white corpuscles. If, for instance, the corpuscles are found to be one white to fifty red, it cannot be assumed that the white are increased to six times the normal, because it may be, as is not unfrequently the case, that the red are reduced to one-third of the normal number and the increase in the white is only double.

It is only within the last few years that we have had at our disposal instruments which permit us to make these observations. The labors of Potain, Malassez, and Hayem in France, succeeding those of Vierordt, Welcker, and others in Germany, have made the method of enumeration of corpuscles available for clinical purposes.

The method formerly employed, first by Donné,[1] and subsequently by Vogel,[2] Robertson,[1] and others, consisted of allowing the slow subsidence of the corpuscles in defibrinated blood, placed in a narrow vessel, and observing the relative thickness of the layers of red and white corpuscles. But this method gives very inexact results, because the red corpuscles fall into closer contact than do the white, and hence the relative increase of the white is exaggerated. Another method is that which was devised by Welcker, and consists in employing the color of the blood as a test of the number of red globules; the tint of a definite dilution of the blood, dried on white paper, is compared with that of a color-scale, and the degree representing the amount of coloring matter is taken as a guide to the number of corpuscles. But this affords information only as to the amount of hæmoglobin contained in the blood—a very inexact guide to the number of corpuscles. The corpuscles are sometimes unusually pale, and the blood thus contains far less hæmoglobin than should correspond with the number of globules it contains. On the other hand, the corpuscles are sometimes smaller than natural, and thus, although not unduly pale, the amount of hæmoglobin is far less than should correspond to the same number of corpuscles. As an illustration of this, I may mention a case of anæmia in which I found the amount of hæmoglobin to be only thirty per cent. of the normal, while the red corpuscles were seventy-five per cent. of the normal average. They were rather small (on measurement) and pale.

The method of ascertaining the absolute number of corpuscles, white and red, in the blood is essentially that which was devised quarter of a century ago by Vierordt, and consists in making a definite dilution of a measured quantity of the blood, and counting the number of corpuscles contained in a certain volume of that dilution. Several modifications of the process have been made, relating especially to the latter part of the process. Vierordt drew uniform lines of the diluted blood along a glass slide, and, after drying, counted the corpuscles in a given extent of those lines. Cramer substituted for this what may be termed a capillary cell, and in the better known methods of Potain and Malassez a capillary tube is employed. Hayem and Nachet have improved upon this by employing a cell of a certain depth. In the writer's modification of Hayem's instrument,[2] the area of the dilution in which the corpuscles are

[1] Loc. cit. 1844.

[2] Virchow's Archiv, t. iii. 570.

[1] Bennett, loc. cit.

[2] This modified "hæmacytometer" consists of—(1) A small pipette, holding exactly 995 cubic millimetres. (2) A fine capillary tube, holding five cubic millimetres. (3) A small glass jar, in which the dilution is made. (4)

counted is determined by divisions on the glass slide at the bottom of the cell, and these divisions are of such a size, and the dilution is in such a degree, that each square corresponds to the ·00001 of a cubic millimetre of blood, and the average number of corpuscles in ten squares multiplied by 10,000 is the number per cubic millimetre of blood. The average of healthy blood was found by Vierordt and Welcker to be 5,000,000, and later results agree with this sufficiently nearly to justify the adoption of this number as the standard. This is the common mode of stating the corpuscular richness of the blood. By this method of counting, however, a much simpler mode of statement is obtained. The average number of corpuscles in two squares (·00002 cubic milimetre of blood) is in normal blood 100. I propose to take this quantity as the "hæmic unit," and the average number of corpuscles per hæmic unit is the percentage proportion to the normal.

The number of white corpuscles varies under normal circumstances from 5000 to 15,000 per cubic millimetre of blood, *i. e.*, ·1 to ·3 per hæmic unit.[1] For the convenient record of the variations in the number of corpuscles in these cases I have arranged a chart, similar to a temperature chart, of which the two lowest divisions are subdivided into tenths for the record of the number of white corpuscles when they are only slightly in excess of the normal. A broken line at 100 is the average number of corpuscles in health; a dotted line at ·3 indicates the normal maximum of white corpuscles.[1]

Considerable caution is necessary in estimating the degree of leucocythæmia from the post-mortem appearance of the blood. The relative bulk of the red and pale portions of the clot constitutes a most fallacious guide, since the bulk of the latter depends mainly on the quantity of fibrin which it contains. Even microscopical examination of portions of the clot is not free from fallacy, since the pale corpuscles aggregate together in such quantities that portions of the clot appear to consist entirely of them, when their excess is moderate. A curious illustration of the difficulty of estimating the excess of pale corpuscles, post-mortem, was afforded by a debate at a French society, in which very different opinions were expressed by pathological authorities regarding the degree of leucocythæmia which was indicated by certain clots. In another case, in which the white and red corpuscles were supposed, from post-mortem appearances, to be in equal numbers, their proportion, just before death, had been found, on actual counting, to be as one to six. The only satisfactory way of examining the blood post-mortem is to take a portion from a vessel in which coagulation has not occurred.

Differential Diagnosis.—Leucocythæmia has to be distinguished (*a*) from diseases which resemble it in general characters, but differ from it in the absence of any excess of pale corpuscles in the blood, and also (*b*) from diseases, the general characters of which differ from those of leucocythæmia, but in which there is such an excess of corpuscles in the blood.

(*a*) Of the former class simple splenic anæmia, anæmic splenosis, as it might be termed, is that which is most likely to be mistaken for splenic leucocythæmia. In splenic anæmia there are the same tumor, the same anæmia, and many of the same constitutional symptoms, œdema, and even hemorrhage. The distinction between the two diseases turns on the presence of a considerable or increasing excess of pale corpuscles in the blood. It has been repeatedly pointed out in this article that the distinction is, as far as we are able to observe, one of clinical character, rather than of pathological origin. The leucocythæmic form may be paralleled,

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The cell, above mentioned, exactly one-fifth of a millimetre deep, the floor of which is ruled in tenth of a millimetre squares. Various diluting solutions have been recommended in order to change as little as possible the aspect of the corpuscles. It is not well, however, to endeavor to observe the characters of the corpuscles during the numeration. Whatever solution is employed the corpuscles are, more or less, changed by it. One which answers very well is a solution of sulphate of soda of a specific gravity of 1025.

The mode of proceeding is simple. A pippetteful of the solution is placed in the mixing vessel. Five cubic millimetres of blood are drawn into the capillary tube from a drop in the finger, and then blown out into the solution. The two are well mixed by a glass rod; a drop of the dilution is placed in the centre of the cell, the covering-glass applied and secured by springs, and the slide placed on the stage of the microscope. The lens is then focused to the squares. In a few minutes the corpuscles have sunk on to the squares. The number in ten squares is then counted.—*Vide* Lancet, Dec. 1, 1877.

[1] Their number, when not numerous, may be best ascertained with the hæmacytometer by observing the number of squares in each field of the microscope, and counting the number of white corpuscles in ten or twenty fields. By this means the average number per cubic millimetre or hæmic unit may easily be ascertained. The white corpuscles may be readily recognized by raising the objective until the corpuscles are fading out of focus, when the greater refractive power of the white corpuscles will render them conspicuous objects.

[1] The hæmacytometer and charts are sold by Hawksley, 300 Oxford Street.

most closely, even in its visceral changes, by an anæmic form of splenic change. Moreover, cases are seen in which every degree of leucocytal excess is present, and many of these are on the boundary line between the two affections, some stationary there, others progressing from the anæmic to the leucocythæmic form.

Spleno-lymphatic leucocythæmia may be mistaken for Hodgkin's disease. In most cases of the primary splenic form the glands are affected late in the disease, and in slight degree, and the spleen is usually very large and regular. In Hodgkin's disease the affection of the glands is the constant occurrence, and the spleen is rarely very large, and is sometimes, though not often, irregular in form. The great excess of pale corpuscles common in splenic leucocythæmia is rarely met with in Hodgkin's disease. In the latter the proportion of one to four is seldom reached, and very rarely, if ever, exceeded; in the former it is frequently exceeded. In Hodgkin's disease the pale corpuscles are, as a rule, smaller than in the splenic affection.

The cases of lymphadeno-splenic leucocythæmia, in which the enlargement of the glands is an initial symptom, occurring with the spleen, the splenic enlargement being great and the excess of leucocytes very considerable, often present much difficulty in their diagnosis. They are really intermediate forms between splenic leucocythæmia and lymphadenosis, the result of a general affection of lymphatic tissues. The larger and smoother the spleen, the earlier it enlarges, the more rapid and extensive the leucocythæmia, the more closely does the disease approach the characters of primary splenic leucocythæmia. The slighter the enlargement of the spleen, the later it occurs, and the slighter the blood change, the more closely does the case approach the variety of lymphatic affection distinguished as Hodgkin's disease.

(*b*) It is seldom that splenic leucocythæmia has to be distinguished from diseases altogether different in general character. The rare cases of leucocythæmia without splenic change can only be distinguished from simple anæmia by a microscopical examination of the blood. In tuberculosis, the pale corpuscles may be increased in number even to three times the normal, but the increase is not progressive and enlargement of the spleen is rare and never considerable.

In some forms of cancer there is a considerable excess of pale corpuscles in the blood. If the cancer be of the abdominal glands or near the spleen, some doubt might exist as to the existence of a splenic leucocythæmia. A careful examination of the tumor would, however, in most cases decide the question.

In suppuration it must be remembered that there may be a large excess of pale corpuscles in the blood. As many as a hundred and fifty have been observed in a field. (See p. 518.) The excess is transient, and disappears soon after the abscess is opened.

In peculiar states of the system, a hemorrhage may cause a considerable excess of white corpuscles to be present in the blood, and the condition might be thought to be one of primary leucocytal excess. The extent of the hemorrhage, the transient character of the blood-change, and the absence of splenic and glandular enlargement, will prevent an error.[1]

Prognosis.—Leucocythæmia is to be regarded as the indication of a disease of the blood-forming organs, depending on an alteration in their structure, which tends to increase, and tends also to extend to other organs, the functions of which are more or less affected thereby. The course of the disease is thus progressive, until a degree of change is reached incompatible with life. At present no means of arresting this progress has been discovered, and the ultimate termination of the developed disease is only too certain.

The prognosis is, however, less immediately grave, as there exists a disproportion between the amount of blood-change and the extent of the organic disease with which it is associated. The prognosis is best in those rare cases in which there is an excess of white corpuscles without any disease of spleen, glands, or bones with which it can be associated. An example of this is the case recorded by Dr. Lloyd Roberts, and before alluded to.

The prognosis is less grave in the early stages of the leucocythæmia. When the blood-change and organic disease are both considerable, the downward progress of the case sometimes varies in its rate, and may be retarded, but it is usually uninterrupted. There are, however, many cases on record in which a condition identical, in all recognizable features, with that of commencing leucocythæmia, has lessened and even passed away under treatment. They are cases in which the splenic enlargement is moderate, the blood-change slight, and in which there are no signs of general cachexia, no profound anæmia, no tendency to œdema or hemorrhage.

In cases of pronounced splenic leucocythæmia, in which the disease has led to general symptoms, considerable blood-change, œdema or hemorrhage, the prognosis is of the gravest character, and death may be anticipated sooner or later as the certain termination. But it is im-

[1 See article on Progressive Pernicious Anæmia, in this volume.—H.]

portant to inquire what indications of rapidity of course and proximate danger are afforded by the several symptoms.

Etiological conditions afford little prognostic indication. Neither sex nor age influences materially the duration of the affection, except that the course of the disease is a little more acute in women than in men, and apparently more rapid when it commences between the ages of forty and fifty, than when it commences at any other period. It is doubtful whether any other causal condition has much relation to prognosis. Instances of slow and rapid course are recorded due to almost every cause. It has been said that cases which are due to malarial poisoning run a more chronic course than others. This is, however, very doubtful. If the period during which a splenic tumor existed, when there was no leucocythæmia, is excluded from consideration, the course of the malarial leucocythæmia has been, in many instances, a very rapid one.

Among the symptoms of leucocythæmia which afford prognostic indications, one of the most important is the state of the blood. The greater the excess of white corpuscles, the graver is the condition of the patient, the greater the liability to serious complications, to hemorrhage, internal and external, and to the diseases of organs which are produced by the accumulations in them of the white corpuscles, and by the lymphoid growths. It may be doubted whether the asthenia, and the tendency to hemorrhages, are not due as much to the deficiency of red corpuscles as to the excess of white, and it is probable that the numeration of the red corpuscles by the hæmacytometer, will afford more definite prognostic information than is forthcoming from a merely comparative observation. Other things being equal, the smaller the excess of white, and the larger the absolute number of red, the better is the prognosis.

The size of the spleen affords little information considered alone. If a large spleen is combined with a considerable blood-change, the case will probably soon terminate. Enlargement of the glands, if distinctly secondary to the splenic enlargement and blood state, is a grave symptom, indicating a widely-spread general change. If occurring simultaneously with the splenic affection, as in the cases of lymphadeno-splenic leucocythæmia, the course of the disease will probably be rapid, especially if the enlarged glands are soft. The cases in which the glandular enlargement is distinctly primary are considered in the next article.

The prognostic significance of hemorrhage varies according to its seat and degree. When extensive, the loss of blood constitutes a source of immediate danger, and renders the prognosis worse by its influence on the anæmia. When moderate, its significance depends on its position. Epistaxis affords little indication. It is frequently an early symptom, and has occurred repeatedly during many years. Hemorrhage from the bowels is of graver significance, and rarely occurs except when the general cachexia is developed, and then is not uncommonly the cause of death. Hæmatemesis is of even worse augury, and where it occurs commonly immediately precedes death. Cutaneous extravasations are also signs of a cachectic state, and occur only towards the end. Œdema is another grave symptom. It is rarely an early occurrence, and when it does occur at the commencement, and is considerable, it indicates an early blood-change, and, usually, a rapid course. When it is slight, however, and shows no tendency to increase, it may exist for a long time, and affords little prognostic indication. Later on in the disease, it indicates, when considerable, a profound degree of anæmia and a speedy termination. It constitutes in itself a source of danger from its influence on the respiratory organs. Diarrhœa, if persistent, is of grave significance; it lessens the patient's strength, and is also not unfrequently the immediate cause of death.

Treatment.—Developed leucocythæmia, associated with distinct changes in the lymphatic organs of the body, has hitherto proved one of the most intractable of maladies. Its progressive course has been arrested by no method of treatment which has been employed. In some cases, however, the patient's condition has been improved, and the course of the disease apparently retarded, and there is reason to believe that, at a much earlier period than that at which the affection usually comes under notice, it has been permanently arrested, and even cured. Further, the little knowledge we possess of its causes suggests that something may be done to prevent its occurrence, and the equally slight knowledge which we have obtained of its pathology does not preclude the hope that means may yet be discovered of arresting its developed course.

The prophylactic treatment of leucocythæmia resolves itself very much into the prevention of its causes. The condition to which it is more distinctly related than to any other is certainly the occurrence of intermittent fever. It is more frequent in ague districts than in others, and it may apparently occur as an effect of malaria which has not produced intermittent fever. Its rarity in this country may not improbably be associated with the practical disappearance of intermittent fever.

There is reason also to believe that the

process of the intermittent does, itself, set up changes which result in leucocythæmia. Many of the cases have succeeded long and repeated attacks of ague, extending, in several, over twenty years. From such attacks we know that a permanent splenic tumor results, as the consequence, apparently, of the repeated congestion of the organ. It is reasonable, therefore, to regard this splenic tumor as the connection between the intermittent and the leucocythæmia, and to believe that by abbreviating attacks of intermittent, and obtaining, by every available means, early contraction of the spleen, the chances of subsequent leucocythæmia may be lessened. The means for this purpose are, it need hardly be said, the free administration of quinine in large doses, care being taken to secure its absorption, and to this may be added the adoption of other measures to be immediately described for promoting the same end.

In all cases in which a chronic enlargement of the spleen exists, great care is necessary to avoid all causes of congestion of the organ. Of these, exposure to cold is one of the most powerful, and is especially hurtful. Cases are on record in which exposure to cold was the only apparent exciting cause of a splenic tumor, and others in which the same cause was the excitant of a fatal leucocythæmia. Besides the measures to be indicated for inducing contraction of the spleen, its congestion may be lessened by the avoidance of all causes of portal congestion, by strictly regulated diet, the prevention of constipation, and by the relief of portal congestion, if it should occur, by aperients.

The precautions indicated are especially needed in women who have been exposed to malaria, or possess any splenic enlargement, during their menstrual or parturient periods. The profound systemic disturbances at these periods have a distinct influence in the production and intensification of leucocythæmia. Such women should observe the greatest care at the menstrual period, to avoid cold, fatigue, mental disturbance, and constipation. If they bear children their strength should be carefully kept up during pregnancy, the loss of blood at parturition as much as possible prevented, and subsequent recovery hastened by hæmatinics. Lactation should be absolutely prohibited.

In some cases simple deficiency of red corpuscles has preceded the increase in the white. It is of the highest importance to remove this deficiency. It must be confessed that its removal is, when associated with splenic enlargement, often as difficult as is that of leucocythæmia, and it may be indicative of quite as profound change in the splenic tissue. An alteration in the spleen, by which pale corpuscles are no longer formed or cannot escape, is almost as grave as one in which they can, although in altered form, still pass into the blood. For this anæmia iron, abundant nitrogenous and easily assimilable food are the customary measures, but it is of the greatest importance that these should be conjoined with an attempt to obtain reduction in the size of the spleen. Alone, hæmatinics are commonly unsuccessful in the treatment of splenic anæmia. In observing their effect, the hæmacytometer is of great utility. The actual number of corpuscles is the best guide to the effect of remedies, and a distinct rise in their number may be evidence of improvement earlier than that afforded by the aspect of the patient or the tint of the mucous membranes. In one case I found iron entirely useless until contraction of the spleen was obtained by galvanism, and with the reduction in the size of the organ (to about two-thirds of its former size) there was a corresponding rise in the number of blood-corpuscles. When iron fails, phosphorus and arsenic may be given.

The treatment which has been adopted for pronounced splenic leucocythæmia has been of five kinds. First, to promote splenic contraction; some agents for this purpose also have an action on the blood. Secondly, to improve the nutrition of the blood. Thirdly, the use of remedies which have a general influence on the nutrition, but have been given, in leucocythæmia, more or less empirically; of these the most important are iodide of potassium, phosphorus, and arsenic. Fourthly, the substitution of healthy for the diseased blood by transfusion. Lastly, the removal of the diseased spleen by operation.

(1) The reduction of the bulk of the spleen has always been one of the principal objects in the treatment of the leucocythæmia. It has been chiefly based on the notion that the spleen was the source of the excess of white corpuscles, that the degree of leucocythæmia was proportioned to the enlargement of the spleen, and that a reduction in the bulk of the organ would be attended by an improvement in the state of the blood. Undoubtedly there is an accumulation of lymphoid corpuscles in the spleen, and these probably grow and multiply there as they do not in the blood. The larger the spleen the greater the amount of corpuscles within it, and the larger the quantity of leucocytes retained in the splenic pulp, the further this is from its normal condition and function. Contraction of the spleen is attended, even in simple splenic tumors, with an expulsion of cells from it, and an increase of white cells in the blood. Thus there is

reason to believe that the production of leucocytes in the spleen may be lessened by contraction, just as it is increased by dilatation and congestion. But when the spleen is greatly enlarged, when its tissue is altered by the lymphatic and connective tissue overgrowth which unquestionably occurs, it is difficult to see how any material change can be effected in the formation or transformation of the lymphoid cells by obtaining a slight contraction in the organ. In the earlier stage of the affection, however, when the lymphatic overgrowth in the organ is trifling, and the tissue elements but slightly altered, a considerable contraction of the spleen may expel a proportion of the contained leucocytes, and, by altering the relation of the rest of the tissue to the blood, the transformation of the corpuscles may be aided. The fact just mentioned regarding splenic anæmia renders it probable that thus permanent improvement, even cure, may be effected, of a condition which may reasonably be regarded as one of commencing splenic leucocythæmia.

Experience is in accord with these conclusions. When leucocythæmia is developed and the spleen is large, no distinct good has been effected by such reduction in the size of the spleen as can be produced under the circumstances. In cases in which the affection has been less advanced, in which the blood-change is slight, and the splenic enlargement is inconsiderable, very remarkable improvement has resulted from this treatment, amounting in some cases to a disappearance of all the symptoms of the disease. It is of course open to some doubt whether these were actually cases of commencing leucocythæmia, but it seems clear that they cannot be distinguished from the early stage of cases in which characteristic symptoms subsequently developed.

Quinine must unquestionably be placed first among the internal remedies for this purpose. It possesses a double influence. It is capable (*a*) of acting directly on the spleen, and, apparently, (*b*) of influencing the vital properties of the corpuscles. (*a*) The normal spleen of dogs[1] and pigs,[2] and the enlarged spleen of man, can be made to contract by its use. It has been suggested that its action is directly on the contractile tissue of the spleen, and this is probable from the fact that the contraction can be obtained after section of the splenic nerves.[3] Jerusalimsky has however asserted that after division of the nerves the contraction produced by quinine is slighter, although it occurs earlier, than when the nerves are untouched, and he suggests that the primary action of the quinine may be on the peripheral nerves and muscular tissue in the spleen, its second action being on the splanchnic and central nervous system. (*b*) The action of quinine on the white corpuscles is to lessen their amœboid movements and arrest their migration through the walls of the bloodvessels. In the frog, Binz found that inflammation of the mesentery was attended with an excess of pale corpuscles in the blood and enlargement of the spleen, and that both lessened on the injection of quinine. He suggested that quinine might cause reduction of the size of the spleen in man by interfering with the production of the pale corpuscles, but there are no other facts to support the view, and the slight utility of quinine in developed leucocythæmia, as Mosler points out, is opposed to Binz's theory. But without going so far, it is certainly possible that a remedy which has a distinct effect on the vital properties of the corpuscles may influence their production and metamorphosis, and that its beneficial effect may be in part due to this influence. Jerusalimsky asserts that after the application of quinine only one nucleus could be rendered visible in corpuscles, in which, before, three were to be seen.

It is in the early stage of the disease that quinine has appeared to be of real service. Mosler records a case of enlarged spleen with an excess of pale corpuscles in the blood, their proportion to the red being one to twenty, in which, after several days' intoxication with quinine, the excess of corpuscles diminished and the spleen lessened in size, and the improvement in both went on to complete recovery. A case in which a cure was apparently effected in which the proportion of white to red was one to thirty or forty, has been recorded by Ehrlich. Farre[1] has recorded a case of moderate splenic tumor, with an "excess" of white corpuscles in the blood, in a woman who had suffered from a tertian ague for a week, a year before. On quinine and iron there was a rapid disappearance of both symptoms. Great improvement occurred also in a case described by Hewson,[2] in which the enlargement of the spleen was moderate although the excess of pale corpuscles was great. But in some cases in which the spleen was lessened in size by the quinine, the course of the disease was not thereby retarded. In other cases, again, quinine, in large doses, has been without influence even on the spleen.[3] It is important to give the quinine in large doses,

[1] Mosler, Binz, Jerusalimsky.
[2] Kuchenmeister.
[3] Mosler, Jerusalimsky.

[1] Lancet, July 6, 1861.
[2] Amer. Journ. of Med. Sciences, vol. xxiv. 1852, p. 365.
[3] Vidal, Gaz. Hebd. 1856, p. 167; Wilks, Guy's Hosp. Rep. 1859, p. 112.

producing and maintaining its full toxic effect. Mosler recommends the hydrochlorate, on account of its greater solubility. Its hypodermic injection does not seem to possess any special advantages.

Ergotine has been employed for the same purpose by Da Costa.[1] Great and permanent improvement was effected in one case, in which the enlargement of the spleen was slight, and the increase in white corpuscles trifling—not more certainly than accorded with the anæmia which existed. In another case, in which the leucocythæmia was decided, a distinct diminution in the size of the spleen was obtained, but the patient died soon afterwards, the course of the disease being apparently uninfluenced. The ergotine was administered by subcutaneous injection, the dose being 5–10 grains every second day.[2] The solution employed was of 40 grains of ergotine, 30 minims of glycerine, and water to 220 minims.

Piperine has been found by Soenderop to produce contraction of the spleen of the dog, and his observation has been corroborated by Mosler. The latter has given piperine in leucocythæmia in doses of 8 to 30 grains, in combination with quinine and eucalyptus.

Mercurial inunctions over the spleen were employed by Addison,[3] and some improvement followed, but they were combined with the internal administration of quinine. Wilks found mercurial inunction useless.

The application of electricity to the spleen of an animal is a ready and certain mode of causing its contraction; and an enlarged spleen in man may also be lessened in bulk by its means.[4] It has been asserted by Botkin that extreme reduction in size may thus be obtained, but it is certainly only in very exceptional cases that this can be produced. Faradization is the readiest form, and is an effective means of causing contraction of the exposed spleen of an animal, and this is the variety which has usually been employed in splenic tumors, but it has failed entirely in the hands of some observers.[5] I believe the interrupted voltaic current to be a much more effective agent. The passage to deeper parts of as trong faradaic current may be almost completely arrested by a thin superficial layer of muscle, which contracts first, while the voltaic current penetrates much more deeply, and is not arrested in a similar manner. In a case of enlarged spleen with simple anæmia, in which I made some careful observations, I found that each application was followed by an immediate reduction in the diameter of the spleen by about one inch, increasing for about half an hour, and remaining for several hours and then passing off. The subsequent increase afterwards did not quite reach the former size, and the habitual size of the organ gradually lessened, until in a fortnight it was permanently reduced about two inches in width. No other treatment was employed at the time, and until the commencement of the application the size of the organ had remained the same. In another case in which the spleen reached the level of the umbilicus and had been stationary for three months, a few weeks' daily application so reduced the size of the organ that it could be only just felt below the ribs. The positive pole should be placed behind, over the tenth rib, and the negative pole on the tumor in front, the current being interrupted by a commutator, or by moving the negative electrode over, or dabbing it on, the organ. As strong a current should be employed as the patient can conveniently bear. In some cases of leucocythæmia even voltaism has failed to produce diminution in the size of the spleen.[1]

The cold douche causes immediate contraction of the exposed spleen of an animal: the organ becomes smaller, darker, and wrinkled.[2] The same effect is produced in slighter degree by the application of the douche to the abdominal wall in the neighborhood of the spleen. It has been found also that in man a cold douche to the splenic region produces very distinct diminution in size of the enlarged spleen. It was employed as an adjunct to the treatment of ague by Currie,[3] and more recently by Fleury. In leucocythæmia, cold douches were recommended by Niemeyer, and also, on the above experimental grounds, by Mosler, who advises the employment of water at a temperature of 55° or 60° F., and an application of from fifteen to sixty seconds. The local application of ice has a similar effect, and may also be used. These means will not, however, alone effect the whole reduction in bulk of which the spleen is capable. In a case of leucocythæmia recorded by Mosler, the length of the spleen was reduced from twenty-five to twenty centimetres in

[1] Amer. Journ. of Med. Sciences, Jan. 1875.

[2] A somewhat large dose of an active preparation.

[3] Lancet, Jan. 7, 1860.

[4] First employed by R. Wagner, Jenaische Annalen, 1849.

[5] Elias, Deutsche Klinik, 1874, No. 5; Andrae, Deut. Zeit. f. prakt. med., 1874, p. 29; Chvostek, Wien. Med. Wochenschrift, 1877.

[1] Chvostek, loc. cit.

[2] Mosler, Virchow's Archiv, 1873, vol. lvii. p. 1.

[3] Medical Report on the Effects of Water, Cold and Warm: London, 1805.

length by cold applications, and then a further reduction to eighteen centimetres was effected by quinine.

(2) The marked effect of iron in simple anæmia, even when the corpuscles are few in number, and the white relatively increased, led to its use in leucocythæmia. It was hoped that, since in simple anæmia it must increase the production of cells capable of being transformed into red corpuscles, or perhaps aid their transformation, it might have a similar influence in anæmia. Any expectation of benefit has, in the developed splenic form, been invariably disappointed. Slight improvement in the aspect of the patient has occasionally been noted, but no diminution in the blood state, or decrease in the spleen. The same inutility of iron alone may be observed in simple anæmia associated with lymphatic overgrowth. I lately had under treatment two cases of anæmia in girls, one of simple anæmia, the other with a large spleen. In each there was profound anæmia, the percentage of corpuscles being in one twenty-six and in the other thirty-six per cent. of the normal. There was no marked excess of white corpuscles in the blood of either. Each was placed on the chloroxide of iron. In the patient with no splenic enlargement, but with only twenty-six per cent. of corpuscles, a rapid improvement occurred. Every enumeration showed an increase in the number of corpuscles, until a percentage of seventy-five, and ultimately, with change of air, of ninety-two, was reached. In the other patient (alluded to previously), the corpuscles remained almost the same, the numbers obtained ranging between thirty and thirty-five per cent., not varying more than three or four per cent. until the spleen was reduced in size by galvanism, when they rose to forty-six per cent.

We know too little of the process of blood-making to infer from these facts that iron must always be useless in leucocythæmia. It is not therefore suprising to find that its influence in this disease should be similar to its effect in anæmia; that simple leucocythæmia, without lymphatic overgrowth, should be benefited by its use, just as is simple anæmia. In Dr. Lloyd Roberts' case a condition of extreme leucocythæmia unattended by any discoverable splenic enlargement or lymphatic disease, was cured by the administration of iron.

Vogel's experience induced him to believe that iron is of service in cases of commencing leucocythæmia in which the splenic enlargement is small. In its use more than usual care must be taken to prevent a constipating effect, since thus splenic enlargement may readily be increased.

Cod-liver oil has sometimes appeared to do good, especially when given in conjunction with iron. The combination of influences brought to bear upon patients at the mineral baths of Germany and elsewhere has seemed, in some cases, to be beneficial. Valentiner[1] mentions one case in which, at Pyrmont, an excess of white corpuscles, associated with a splenic tumor, disappeared. In other cases, however, similar treatment has been useless.

(3) Arsenic, from its general tonic influence and its power of influencing many obscure morbid processes, has been used in leucocythæmia, but without any distinct benefit.[2]

Phosphorus has been given in leucocythæmia on empirical grounds. It was first recommended in splenic tumor by Dr. Broadbent,[3] who had found that it was capable of producing some of the therapeutical effects of its congener arsenic. A case of enlarged spleen with anæmia and slight excess of white corpuscles presented, under its use, marked diminution in the anæmia and in the size of the spleen. In a case recorded by Dr. Wilson Fox a marked diminution in the excess of corpuscles was observed, and the patient's health appeared much improved. The patient, however, subsequently died from the affection. In a case of lymphadeno-splenic leucocthyæmia I observed a reduction of the corpuscles from one white to four red to one white to one hundred red under its use; but there was reason to ascribe its effect to its influence on the lymphatic glands rather than on the spleen, and the patient died from renal disease.

This case suggests that it may exercise an influence by its known property of causing fatty degeneration; it may thus cause the early degeneration of the white corpuscles, or possibly of the growing cells from which they are formed, and thus may lessen their number. Those organic disturbances which depend upon the excess of leucocytes may thus possibly be lessened. But on the other hand some facts suggest that the formation of red corpuscles may, by its influence, be promoted. I have twice found that in lymphadenoma the percentage of red corpuscles steadily increased under its use. It is only at an early stage of the disease that such an influence can be looked for. In every other case in which the excess of white corpuscles was considerable phosphorus has not appeared to have any beneficial effect.[4] It is very desirable that

[1] Deutsche Klinik, 1860, p. 200.

[2] Oppolzer, Bourdon, Valentiner, Berl. Kl. Wochen. 1865, 321.

[3] Practitioner, Jan. 1875.

[4] Sir W. Jenner, Clin. Soc. Discussion, Lancet, 1876, ii. p. 787. Moxon, Clin. Soc. Trans. 1875.

in cases in which it is employed the numbers of red and white corpuscles should be observed and their changes followed by the hæmacytometer.

Iodide of potassium has also been given and found practically useless. Under its influence Mursick observed a transient diminution in the spleen and glands, but no permanent effect. Bromide of potassium, and mercury, the latter pushed to salivation, have also been apparently entirely without effect.

The fact that the pale corpuscles of the blood are increased during suppuration and diminish with the evacuation of the pus, led Apolant[1] to suggest that their number in leucocythæmia might be lessened by the formation of a freely suppurating surface. He made some observations on animals, from which he concluded that the number of pale corpuscles could be lessened by suppuration. The suggestion has not yet, I believe, been applied to the treatment of leucocythæmia, and there is no reason to expect that the gravest element in the blood state, the paucity of red globules, would be lessened by it.

(4) The morbid state of the blood being, in most cases of leucocythæmia, the direct or indirect cause of death, it has seemed a reasonable measure to substitute healthy for the diseased blood by transfusion. The results of the operation have not, however, been very favorable. Transient improvement has followed; in a case of Mosler's there was a diminution in the size of the spleen and an improvement in the blood, but no lasting influence on the disease. In most cases the quantity injected has been small—four or six ounces—and it is evident that if the leucocythæmic state were well developed, as in all the cases in which it has been employed, the injection of a quantity which bears so small a proportion to the total mass of blood, can effect very little alteration. Repeated transfusion has therefore been suggested, but it has not yet been tried. The injection has been made in most cases into a vein, and the veins of the foot have been recommended as farthest from the heart. The farther from the heart a transfusion is made, the larger the quantity of air necessary to produce dangerous consequences. Arterial transfusion was recommended by Heute and tried at Breslau; defibrinated arterial blood was injected into the radial artery, with the result of causing sudden death, on which the post-mortem examination threw no light.[2]

(5) Excision of the spleen has been performed in a few cases of leucocythæmia in the hope that the disease might be thereby arrested.[1] In no case, however, has the patient survived even the immediate effects of the operation. Death has, in most, been due to hemorrhage from vessels which were in a position (as in splenic adhesions) in which they could not be secured. In a few cases of simple splenic hypertrophy, without leucocythæmia, the operation has been successful. In leucocythæmia the tendency to hemorrhage is unquestionably greater than in most cases of simple splenic anæmia; and this constitutes a danger so great as to render the operation scarcely justifiable in the advanced stages of the disease. Naturally, a risk of immediate death so great as is, and must be, involved in the operation, is only consented to when the disease is advanced, and the patient's danger one of which he is conscious by symptoms, such as œdema and dyspnœa, in themselves indicative of the greatest source of risk—the profound blood-change. We are yet, moreover, without any evidence as to whether the removal of the spleen would be attended with an improvement in the deficiency of red globules, which constitutes the gravest source of danger. It is much to be desired that in any future cases of splenotomy for simple hypertrophy, the changes in the blood-state after the operation should be carefully followed by numeration of the corpuscles.

The several symptoms of leucocythæmia are often so urgent as to need special treatment. One is the frequent and severe hemorrhage. This has to be checked by local pressure, cold applications, and astringents applied locally. The application of crystals of perchloride of iron, as recommended by Sir William Jenner for the hemorrhage in hæmophilia, is one of the most powerful styptics. With these may be combined the hypodermic injection of two or three grains of ergotin. Hemorrhage from the stomach and bowels must be treated in the usual manner; injection of ergotin, with astringents by the mouth. Vomiting is best relieved by a posture which lessens the pressure on the stomach, by the ordinary gastric sedatives, and especially by counter-irritation. The diarrhœa often needs strong and repeated astringents, tannin preparations, or lead, with opium. Constipation should be avoided, but gentle aperients only must be employed to counteract it, on account of the liability to, and danger of, diar-

[1] Virchow's Archiv, Bd. 59, p. 302.

[2] Schmidt's Jahrbuch, vol. clx. 1873, p. 50.

[1] Bryant, Guy's Hosp. Rep. 1866, p. 444; Ibid. 1867, p. 411; Kœberlé, Gaz. Hebd. 1867, No. 43; Browne, Lancet, ii. 1877; Billroth, Wien. Med. Wochenschrift, 1877. Other unsuccessful cases, in which leucocythæmia was not observed, or was noted to be absent, have been recorded by Quittenbaum, Kuchler, and Spencer Wells, and two successful cases by Péan.

rhœa. Splenic pain is best relieved by counter-irritation, sedative liniments, and hypodermic injection of morphia. It may often be lessened by the avoidance of the causes of gastric distension. For the œdema, diuretics and cardiac tonics, especially digitalis, are the most useful. Purgation, for its removal, is inadmissible. For the dyspnœa, inhalations of oxygen have been employed by Jaccoud and Sizer, and have been found to give relief, but only of a very transient character.

In all means employed, the utmost care must be taken to avoid any measures likely to lessen the patient's strength. Some of the symptoms are often misapprehended, and unnecessary and very injurious attempts are made to remove them. This is especially the case with the œdema, the abdominal fulness, and the "icterus lienalis." For all these free purgation is sometimes employed, and the patient's downward course is thereby rapidly accelerated.

HODGKIN'S DISEASE.

By W. R. Gowers, M.D.

Synonyms. — *Growth.*—Vascular Sarcoma of the Lymphatic Glands, Craigie; Malignant Lymphoma, Billroth; Lympho-Sarcoma, Virchow; Malignant Lympho-Sarcoma, Langhans; Lymphadenoma, Wunderlich, Ranvier; Desmoid Carcinoma, Schultz.

Disease.—Anæmia Lymphatica, Wilks (1862), (Hodgkin's Disease, Wilks, 1865); Pseudo-Leukæmia, Cohnheim, Wunderlich; Adénie, Trousseau; Lymphadénie, Ranvier; Lymphatic Cachexia, Mursick.

Definition. — Hodgkin's disease, or lymphadenosis, as it may be conveniently termed, is an affection characterized by a widely-spread enlargement of the lymphatic glands, commonly also by an enlargement of the spleen, and by progressive anæmia. The enlargement of the glands and spleen is due to the growth in them of adenoid tissue, having a tendency to undergo a fibroid transformation, and in the spleen to be localized in isolated masses. In many cases disseminated growths of similar structure occur in other organs, especially in the intestinal canal, the liver, and the kidneys. The blood presents invariably a diminution in the number of red blood corpuscles, occasionally an increase in the white corpuscles, usually inconsiderable.

History. — Malpighi[1] was the first writer to mention the association of general enlargement of the lymphatic glands with nodules in the spleen, but special attention was first called to the association as the salient feature of certain cases of disease by Dr. Hodgkin[1] in 1832. Of the series of cases Dr. Hodgkin published, some are clearly instances of other morbid states, but at least two are examples of the special disease now called after him.

Many previous writers had alluded to or described instances of general enlargement of the lymphatic glands, but most of these were regarded as scrofulous or cancerous. A well-described and remarkable example of the former was described by Morgagni, by whom it was related, in 1752.[2]

[1] De Viscerum, Lond. 1669, De Liene, cap. v. "De quibusdam corporis per Lienem dispersis." Speaking, p. 131, of the manner in which these bodies could be rendered visible, he says, "In homini difficilius emergunt, si tamen ex morbo universum glandularum genus turgeat, manifestiores redduntur, auctâ ipsarum magnitudine, ut in defunctâ puellâ observavi, in quâ lien globulis conspicuis racematim dispersis totus scatebat."

[1] Medico-Chirurgical Transactions, vol. xvii. 1832, p. 69.

[2] Epist. lxviii.; Cooper's Trans. p. 604. The case was that of a boy, aged 15, who observed the enlargement of the glands of the neck three months after a severe mental shock. The glands beneath the jaw, in the neck and thorax, were all enlarged, and tumors of the same character existed in the integuments of the abdomen, and in the abdominal cavity. The progress of the disease was rapid, and accompanied with fever. After death the tumors were found full of whitish matter, in some rather fluid, in others solid, and some were suppurating. The whole omentum was full of strumous tubera, and masses, from a hen's egg to that of a pigeon's in size, occupied the peritoneum, pancreas, and mesentery. There was also apparently similar growth in the tissue about

The condition appears to have been that characterized by Craigie in 1828, as "enlargement with induration" or "vascular sarcoma" of the glands; and he carefully distinguished between this enlargement with induration, non-caseating, and the caseating strumous enlargement which he afterwards designated "tyroma glandularum." He also drew an accurate distinction between it and cancer, with which it had, he says, been confounded.[1]

Dr. Bright noticed the frequency with which tubercular disease of the lymphatic glands was associated with that of the spleen, and alluded to Dr. Hodgkin's observations, detailing again some of Dr. Hodgkin's cases.[2] Velpeau, in 1839,[3] drew attention to the fact of the occurrence of glandular hypertrophy, independently of scrofulous disease.

The discovery of leucocythæmia, and of the fact that the lymphatic system participates in the morbid process, drew closer attention to the affections of the lymphatic glands. In 1848 Virchow published a case of general enlargement of the glands, without affection of the spleen, in which the clots, found post-mortem, appeared to contain an enormous excess of white corpuscles. Dr. Hughes Bennett, in reproducing this observation in 1852, drew attention to Dr. Hodgkin's earlier paper. Larrey in 1852 alluded to the disease in general terms, but adduced as an example the case recorded by Morgagni. A case was brought by Dr. Markham[4] before the Pathological Society in 1853, in which the first microscopical examination of the growths in the spleen was made by Dr. Bristowe. The condition, however, attracted little notice until a fresh series of cases was described in 1856 by Dr. Wilks,[5] who pointed out their resemblance to those described by Dr. Hodgdin.[1] In the same year an observation was communicated to a French Society by Bonfils, and in 1858 two characteristic cases were carefully described by Wunderlich,[2] who called attention to their distinction from tubercular and carcinomatous affections. The structure of the enlarged glands was carefully described by Billroth[3] in 1858. In 1859 a case was published by Pavy, and in 1860 Potain published a thesis on the effects of hypertrophy of visceral glands. In 1861, cases were published in this country by Mr. Jonathan Hutchinson, and abroad by Cossy,[4] Potain, and Perrin. Since then a large number of cases have been placed on record. In 1864 the pathological features and relations of the disease were briefly described by Virchow.[5] In 1865 Dr. Wilks[6] collected the cases which he had published, and compared their features; and in the same year another collection of cases was made by Cornil, and Trousseau[7] published a clinical lecture, in which he brought forward several new cases, and gave a general description of the disease. Wunderlich published a fresh collection of cases in 1866. In 1867 the microscopical characters of the disease were described by Ollivier and Ranvier, and by Billroth; and in 1869 fresh observation of its structure, by Dr. Burdon Sanderson, were included in an account of the history and symptoms of the disease by Dr. Murchison.[8] Since that time several small collections of cases have been published, in this country especially by Dr. Southey,[9] and in France, in the theses of Rousseau (1874) and Grocler (1873), and in Germany by Schultz and Langhans.

VARIETIES.—A distinction has been drawn between the forms in which the glands are hard and those in which they are soft. The more acute the process the softer are the glands, the greater is the proportion of cells in them, and, it has been thought, the greater is the tendency for the cells to pass into the blood, and to persist there as an excess of white corpuscles. Hence the softer varieties have been regarded as examples of "lymphatic

each kidney. The glands in the small intestines were enlarged. One tumor, as large as a hen's egg, existed in the mediastinum and compressed the trachea. There were hard and stony globules the size of grains of barley on the surface of the lungs, and strumous tumors were situated in the costal pleura.

[1] Path Anatomy, 2d edit. 1828, Diseases of Glands, p. 250. "The great hardness and the malignant tendency of this growth have procured for it from most authors the ominous names of scirrhus and cancer. Though correct enough for all practical purposes, these epithets are not justified by the anatomical characters." He describes it as consisting of amorphous granular masses united by dense filamentous tissue.

[2] Guy's Hosp. Reports, vol. iii. 1838, p. 405. These have been quoted as separate cases.

[3] Leçons Orales de Clinique, t. iii.

[4] Path. Trans. vol. iv. p. 177.

[5] Guy's Hosp. Reports, third series, vol. ii. 1856, p. 114.

[1] Receuil des Travaux de la Société Médicale d'Observation, t. i. p. 157.

[2] Archiv für physiologische Heilkunde, 1858, vol. ii. new series, p. 123.

[3] Beiträge zur path. Histologie, 1858, p. 168.

[4] Cossy, Echo Méd. de Neuchâtel, 1861, t. v. Nos. 13 and 14, extracted in Gaz. Hebdom. Dec. 20, 1861.

[5] Krankhaften Geschwülste, vol. ii.

[6] Guy's Hosp. Reports, 1865, vol. xi. p. 56.

[7] Clinique Médicale, t. iii.

[8] Path. Trans. vol. xxi. 1870.

[9] St. Bartholomew's Hosp. Reports, vol. ix. 1873, p. 46.

leucocythæmia," and distinguished from the harder forms, which have been termed "lymphosarcoma." But it will be seen that there may be no excess of leucocytes in the blood, even when the glands are soft; and there may be an excess when the glands are hard; that the same case may present both hard and soft glands, and that the two conditions may even be but different stages of the same affection.

Varieties may be distinguished according as the glandular affection exists alone or is associated with enlargement of the spleen, and as the latter depends upon the presence of limited growths, or of a diffused increase in the pulp tissue. The distribution of the glandular enlargement also constitutes a salient distinction between different cases. In some it is general, and uniform in degree; in others, certain glands are much more enlarged than others, and these may or may not be the glands first affected. In some cases, again, one group of glands may be the seat of great enlargement, and constitute a tumor having the characters of a local growth. These varieties of distribution may be thus classified—

1. Local growth only.
2. Local enlargement preponderating. { *a.* primarily. *b.* secondarily.
3. General uniform affection. { *a.* secondarily general. *b.* primarily general.

The first and last stand at the extreme limits; in the one the causes of the disease act solely on one part, in the other they act with equal force on all the lymphatic glands of the body.

Each of these varieties may be associated in any degree with an affection of the spleen, and with growths in the organs of the body, and each with an excess of white corpuscles in the blood. The first, however, in which the glandular growth is limited to one set of glands, appears to possess the characters of a local growth, and it is doubtful in what relation they stand to the cases in which the glandular disease is more widely spread. Those cases are, therefore, described in this article incidentally, and only those cases are analyzed in which several groups of glands were diseased.

Growths in the viscera, such as occur in association with glandular disease, sometimes also occur alone, either limited to one organ or occurring in several. These are likewise discussed incidentally, and only such cases are included in the analysis as presented also enlargement of several groups of glands.

ETIOLOGY.—Recorded cases throw very little light on the causes of lymphadenosis. In a large number of cases the affection commenced while the patient was apparently in perfect health, and no antecedent morbid influence could be traced, near or remote, to which the disease could be ascribed. This was the case in 62 cases out of 114 available for comparison. In many of those in which an antecedent condition, possibly connected with the disease, was to be traced, its influence, on account of chronological remoteness and other circumstances, was very doubtful. It is probable that the largest proportion of cases in which any etiological condition can be distinctly traced is one-third. Those conditions themselves are, in various cases, of the most diverse character, and evidently constitute but a small proportion of the unknown factors.

Heredity.—The complete absence of any evidence suggesting the transmission of lymphadenosis renders it highly probable that the disease, as such, is not inherited. Almost the only facts which point to such an influence are a case recorded by Chvostek, in which the father of the patient died from hemorrhage after the extraction of a tooth, and a case recorded by Muller, in which the patient was a man aged fifty-two, and it is stated that all his children had a tendency to enlarged glands. Nor is there much evidence of the affection of collaterals. It is possible that more careful investigation into the history of cases in patients about whose relations reliable information is to be obtained, may show that in some forms of lymphadenosis there exist relations to other forms of disease, especially to phthisis and scrofula. In a few patients there has been evidence of a strong phthisical taint, even when the gland disease possessed very distinctive features. In one case,[1] a child, aged eight years, was born six months before the death of the mother from phthisis, which existed during the pregnancy. The relations of the disease to scrofula are still more intimate. This is suggested by such examples of generalized scrofulous enlargement of glands as in the case described by Morgagni (p. 529), and by such facts as the following. In a case described by Mosler, a child, of scrofulous heredity, suffered at nine months from suppurating enlargement of cervical glands, and after measles, æt. two, presented indolent gland enlargements, of the consequences of which he died at five. The glandular disease was universal, and characteristic of this affection; there were nodules of growth

[1] Recorded by Mr. Jonathan Hutchinson, Path. Trans. vol. xii. p. 230.

in kidneys, but the spleen presented, as it often does in lymphadenosis, numbers of small spherical yellow nodules, such as are sometimes seen in tubercular disease. In several other cases the glands first affected have suppurated, those subsequently diseased presenting all the characters of lymphadenoma.

Sex.—The disease is three times as frequent in males as in females. Out of 100 cases 75 occurred in males and 25 in females. The preponderant affection of the male sex is thus greater than in splenic leucocythæmia.

Age.—The disease occurs at all ages, from one to seventy years. It is, however, more frequent in early and in late adult life. In middle life the disease is less frequent than at any other period. It has been observed in children only a few months old.[1] From the frequency of glandular enlargements in children, it might be expected to be especially common in early life; but this does not appear to be the case. Indeed, if regard is had to the larger number living, it is as infrequent in childhood as at any period of life. These inferences are based on the following table of the ages at which death occurred in 100 cases. In consequence of the difficulty of fixing the commencement of the disease in individual cases, it is only practicable to compare the ages at death:—

	Males.	Females.	Total.
Under 10 years	9	7	16
Between 10 and 20 years	12	2	14
" 20 " 30 "	16	4	20
" 30 " 40 "	9	5	14
" 40 " 50 "	3	2	5
" 50 " 60 "	18	3	21
" 60 " 70 "	6	1	7
" 70 " 80 "	2	1	3
Total	75	25	100

It thus appears that one decade, between forty and fifty, presents remarkable freedom from the disease. It is more frequent under ten years of age than splenic leucocythæmia, and less frequent during middle life; for whereas two-thirds of the cases of splenic leucocythæmia occur between twenty and thirty, only two-fifths of the cases of lymphadenosis occur during the same period.

The preponderant affection of males is seen at each period of life, but varies at different epochs. It is least under ten years and at the period of life at which the disease is least frequent, viz., between forty and fifty years. At each of these periods the proportion is about as three to two; but the numbers during the latter period are too small to be relied upon. The preponderant affection of men is greatest between ten and twenty years, and between fifty and seventy; during each of these periods the proportion is as six to one.

Intemperance has appeared occasionally to have contributed to the production of the disease, but in so small a proportion of the total number of cases (7 out of 114) that its influence is manifestly slight. All of the cases were males, and most of them (five) past middle life.

Mental Depression preceded the onset of the disease in five cases; three were men and two women.

Insufficient Food in several cases was supposed to have been the cause of the disease, but in some of them it operated in conjunction with other influences. *Over-exertion* was regarded in some instances as aiding other causes, especially imperfect nourishment and exposure.

Exposure to Cold, in several cases, preceded the early symptoms of the affection. In some instances the exposure had been long continued, and had been combined with severe exertion or insufficient nourishment. In others, a single severe chill determined a series of symptoms eventuating in the glandular enlargement.

Constitutional Syphilis, from the character of the tissue changes which it produces, might be expected to be a common cause of lymphadenosis, but in only three cases was the disease ascribed to it. In one the primary disease occurred only eight months before the commencement of the glandular enlargement, and in the interval the patient had suffered from a syphilitic roseola. Iodide of potassium did not, however, hinder the rapid progress of the disease. In another the glands lessened slightly under iodide of potassium; in the third, in which primary syphilis had been contracted nine years before, anti-syphilitic treatment had no effect. The relation of the disease to syphilis may therefore be considered to be doubtful.

[1] It has been asserted by Bednar that a similar condition of anæmia, glandular swelling, and enlargement of spleen, liver, and kidneys, occurs as a congenital disease, but no cases are given (Krankheiten der Neugebornen u. Säuglinge, Wien, 1850, p. 155). The occurrence of a similar condition in children at the breast, associated with leucocythæmia, has been described by Golitzinsky (Jahrbuch für Kinderheilkunde, 1861).

Child-bearing.—In only one case did the disease apparently commence during pregnancy. The progress of the disease was, in another, distinctly checked during pregnancy, and it advanced rapidly after delivery. In several cases the first symptoms of the disease were observed soon after childbirth, and in one of these, recorded by Trousseau, there had been a large post-partum hemorrhage. Two cases have been recorded by Dr. R. Paterson[1] in which very rapid and general enlargement of the glands occurred after delivery, killing the patient in a few weeks, and accompanied with extreme leucocythæmia. In one of these cases there was considerable enlargement of the spleen, and the affection appeared to have commenced during pregnancy; in the other the enlargement of the spleen was only noted during the last hours of life, the swelling of the glands was so extreme that the patient died from the asphyxia produced by the pressure of the cervical tumors.

Febrile Affections.—In very few cases has lymphadenosis succeeded a general febrile disease. One of Dr. Hodgkin's cases apparently originated in an exposure to cold during the convalescence from a fever. In some instances (5 out of 114) the patients had suffered previously from intermittent fever. In one patient the disease succeeded hooping-cough.

Local Irritation.—It was pointed out by Cragie and by Trousseau that in some cases a local irritation had appeared to be the exciting cause of the glandular swellings. It has already been mentioned that in some cases local glandular enlargement has preceded, for a time, the general affection. In some of these patients the local glandular swellings could be attributed to no exciting cause, but in others they were apparently due to a local irritation. The irritation of a decayed tooth, of chronic coryza, and of discharge from the ear, appeared, in three cases respectively, to be the causes of an initial enlargement of the cervical glands. In three other cases a sore throat appeared to produce the same effect. In one, for instance, a catarrhal tonsillitis was followed by considerable and permanent enlargement of one tonsil, and subsequently, of the lymphatic glands of the neck. The sore throat, in one case, was syphilitic in character. The disease commenced, in two cases, by enlargement of the glands secondary to an inflammation of the lachrymal sac, and in one of these the glands first enlarged suppurated. Dr. Wilks has recorded a case in which the disease commenced by enlargement of the glands of the groin, apparently excited by a soft chancre. General eczema, in another patient, preceded a generalized onset of the affection. There is thus reason to attribute some effect in the production of the disease to such irritation as does, not uncommonly, set up simple glandular enlargements. The significance of this will be discussed in the section on Pathology.

[1] Edin. Med. Journal, 1870, p. 1074.

PATHOLOGICAL ANATOMY. — In all cases of lymphadenosis, with the exception of certain very rare forms of visceral growth, there is found enlargement of some of the lymphatic glands; in most, there is also enlargement of the spleen; and in a considerable number there are lymphatic growths, *i. e.*, growths of adenoid tissue, in other situations, in the alimentary canal, in the kidneys, in the liver, in the medulla of bone, and occasionally in the lungs, in the testicles, and in the heart.

LYMPHATIC GLANDS.—The lymphatic glands are arranged in groups throughout the body, some superficial, others deeply seated within the visceral cavities. Many, often all, the glands of the same group are diseased. The affection may be confined to one or two groups; more commonly it involves several groups, those which are deeply seated in the visceral cavities as well as those which are superficial. Not unfrequently all the glands, deep and superficial, are diseased. The several groups of glands are affected in the following order of frequency, the first being those most frequently diseased:—

(1) Cervical; (2) Axillary; (3) Inguinal; (4) Retroperitoneal; (5) Bronchial; (6) Mediastinal; (7) Mesenteric.

Certain subsidiary groups of glands are often diseased in association with those adjacent, as the submaxillary and occipital with the cervical, the epitrochlear with the axillary, the popliteal with the inguinal. Nodular growths, precisely resembling enlarged lymphatic glands, may be found in situations in which the existence of glands is not usually recognized. These arise either from the enlargement of small glandular structures which, in the normal state, pass unnoticed, or from the development of adenoid tissue along the course of the lymphatic vessels. Such are the chains of growths often observed beneath the pectoral muscle extending upwards from the axilla to the neck, or inwards to the mediastinum. In most cases the glands are enlarged on both sides, but the same group may be affected on one side only, or on the two sides in very different degree.

The size attained by the individual glands varies from that of a nut to that of a pigeon's egg, or even a hen's egg, while the mass formed by the enlargement of a whole group may reach a considerable

size, equalling that of a child's head, in either the neck, axilla, thorax, or abdomen. In one case the whole of the enlarged glands weighed ten pounds. In shape the individual glands are oval or rounded, sometimes flattened by pressure. At first they are separate, and freely movable one on another. Commonly, after a time, the glands unite to form a conglomerate mass in which the several glands are no longer movable. Sometimes glands in one group, which is the largest, are thus fixed, while those of other groups remain movable. This adhesion of the glands to one another is usually a consequence of the perforation of their capsule by the growth which causes their enlargement, and its extension from one gland to another; more rarely it is due to a process of peri-adenitis, involving the tissues adjacent. When the growth has thus passed beyond the limit of the gland itself it may extend in the adjacent connective tissue, invade a contiguous organ, or perforate a large vessel. It is rare for the skin over superficial glands to be affected, but occasionally it becomes involved in this manner. The proper elements of the tissues thus invaded undergo atrophy, fibrous structures are infiltrated and split up by the lymphoid cells, epithelium and muscular tissue degenerate. The enlarged glands often exert pressure on adjacent parts, may displace organs, and interfere seriously with hollow viscera.

Affection of the several Groups of Glands.—Although the groups of glands are named according to their position, it must be remembered that, as already stated, there are outlying groups of glands which are included in the several groups, and that between the several groups continuous chains of growths may exist.

Cervical Glands.—The group of glands in the posterior triangle, above the clavicle, is generally affected, and may form a mass of very large size. Those in the upper part of the neck, along the sterno-mastoid muscle, are also enlarged, and frequently those which lie beneath the lower jaw, submaxillary glands; and at the back of the neck, occipital glands. The submaxillary glands may meet in the middle line, and encircle the neck below the jaw. A chain of enlarged glands may extend, upwards, along the internal jugular vein to the base of the skull; downwards, beneath the clavicle and pectoral muscle, to the axilla; and also along the trachea into the thorax, where they may be continuous with the mediastinal or bronchial glands. A large growth from the lower cervical glands may descend in front of the clavicle and lie over the upper part of the thorax. The cervical tumors may exercise serious pressure on the structures in the neck. If the enlargement is much greater on one side than on the other, the larynx may be displaced. The pressure on the trachea may interfere with respiration, and even cause death by suffocation. This less frequently results from pressure in the neck than from the pressure of the thoracic glands on the lower part of the trachea. The enlarged glands in the neck may press on the recurrent laryngeal and cause paralysis of the larynx. Those more deeply seated may compress the internal jugular vein and cause thrombosis in it. When the growth is invasive in its character, it may infiltrate the wall of the vein.[1]

Axillary Glands.—These are frequently diseased and often attain a very considerable size; they may weigh one or two pounds. Those which lie in the anterior part of the axilla often extend beneath the pectoral muscle by finger-like prolongations. Occasionally the epitrochlear glands above the elbow are also diseased. The glands in both axillæ are usually enlarged, but they are always larger on one side than on the other. There is no regularity in the order of these glandular enlargements. Sometimes the glands in the neck and axilla are largest on the same side: but in other cases the glands on one side of the neck and in the opposite axilla may be enlarged first and chiefly.

Thoracic Glands.—Those in the anterior mediastinum are often enlarged, and, not unfrequently, the disease commences in, and may be limited to, this group. The growth here often extends beyond the glands and invades adjacent structures. The thymus may be thus invaded. Occasionally the growth begins in the thymus, and the tumor produced is, according to Virchow, more uniform and less nodular than that which results from primary enlargement of the glands. Sometimes the thymus remains free, and has been found, in children especially, in a normal state, although surrounded by masses of enlarged glands. In other cases the growth extends in the cellular tissue of the anterior mediastinum, passing between the sternum and the pericardium, and reaching from the highest part of the pericardium to the diaphragm. When the enlargement is considerable, the heart and left lung are frequently displaced. The growth may be closely connected with the sternum, and may perforate the pericardium. Sometimes the pericardium is not invaded although the growth spreads widely in its vicinity.

The glands which lie beneath the arch of the aorta, and have been termed the *cardiac* glands, are sometimes diseased, and much more frequently the *bronchial* glands, which are adjacent to the bifurcation of the trachea, the bronchi, and the

[1] Schultz, Arch. der Heilkunde, 1874, Case 5.

roots of the lungs. These are numerous, and, by their enlargement, constitute frequently a mass of considerable size, which may be continuous above, along the trachea, with the cervical glands. The trachea and bronchi are frequently pressed upon, and may be so narrowed as to interfere with the passage of air. Sometimes the trachea, although surrounded by growth, is not compressed. Trousseau has pointed out that the great vessels rarely suffer from compression. The growth here is frequently invasive, and may perforate the posterior surface of the pericardium, often in many places. The perforating growth may have a smooth concave surface within the pericardial sac to correspond with the adjacent portion of the heart.

Frequently the growth from the bronchial glands extends on each side into the lungs, passing into them around the bronchial tubes. Occasionally the bronchial glands escape, even when those of the anterior mediastinum are extensively diseased. The glands which lie in the posterior mediastinum, around the aorta and œsophagus, may be enlarged and connected in front with those around the bronchi, and above with those adjacent to the pharynx. They do not often compress the aorta or œsophagus, or the thoracic duct. The pressure in the azygos veins has caused thrombosis in them, with extensive pleural effusion.[1] Occasionally, in those forms in which the growth spreads widely, the vertebræ may be invaded.

Abdominal Glands.—The retro-peritoneal glands, which lie along the spine beside the aorta and vena cava, are most frequently affected, and often form a mass of large size, which may be continuous above with the glands in the thorax, and below may extend along the iliac vessels and down into the pelvis. In a case recorded by Bonfils the pelvic and lumbar glands together weighed eight pounds. These glands rarely exercise much pressure, but those within the pelvis have been known to press on a ureter and cause its dilatation above the part compressed. Occasionally the retro-peritoneal glands in front of the spine surround and compress the solar plexus. When this is the case there may be bronzing of the skin although the supra-renal bodies are healthy. Some years ago I made a post-mortem examination on the body of a patient of Sir William Jenner in which this was the case. The glandular enlargement was general, but in the thoracic and abdominal cavities it was very great. The supra-renal body on each side was healthy, but the nerves from each passed into the mass of gland growth by which the solar plexus was inclosed. The bronzing of the skin was striking, and had the distribution characteristic of Addison's disease. A very similar case has been recorded by Féréol.[1] Other instances of discoloration of the skin will be mentioned in speaking of its changes.

The *Mesenteric* glands are sometimes enlarged, but far less frequently than the retro-peritoneal group, and less frequently, indeed, than any others. When diseased, the size they attain is commonly moderate, the individual glands rarely exceeding that of a pigeon's egg. They are often continuous with a chain of glands which extend up along the gastro-hepatic omentum to the liver—portal glands. These may compress the portal vessels and the bile duct. The glands in the gastro-splenic omentum and the hilus of the spleen may also be enlarged. The size attained by these visceral glands is sometimes considerable. In one case the portal glands formed a mass the size of a child's head.[2] The glands about the pancreas are sometimes diseased, and so also are those of the meso-colon.

The *Inguinal Glands* are affected in about half the cases. They often attain a large size, and may be continuous beneath Poupart's ligament with the iliac glands. The femoral vessels and crural nerves may be compressed. Other enlarged glands or gland-growths may extend down the thigh along the femoral vessels. The popliteal glands are also sometimes enlarged, but rarely to a considerable extent.

Characters of the Glandular Enlargement.—The physical characters of the glands depend on the rapidity and duration of the enlargement, and on the characters of the growth causing it. The consistence of the glands varies. In some cases they are soft; in others of semi-cartilaginous hardness. Virchow distinguished between these forms. In some cases, however, the characters of the enlargement are not uniform: the large glands may be soft and the smaller firm and elastic. Or the converse relation may be observed, the small glands may be soft and the larger hard. In other cases, the more deeply-seated glands may be soft and fleshy, while the superficial glands are tolerably firm. Enlarged glands may be at first soft, and afterwards become much harder. The capsule is often normal in thickness, now and then it is thickened by a process of peri-adenitis, and sometimes it is perforated by growth from the interior of the gland.

The appearance of a section varies considerably. It is usually more or less

[1] Dr. J. J. Black, American Journal of Medical Sciences, April, 1868.

[1] Férćol and Nieszkowski, Gaz. des Hôp. 1867.

[2] Desnos et Barié, Gaz. Méd. de Paris, 1876, Nos. 34 and 35.

uniform, the normal distinction between cortex and medulla having disappeared. The color is whitish or yellowish-gray, mottled with red in proportion to the vascularity of the gland. Sometimes the follicles have a different appearance from the rest of the gland, either due to a thickening of the septa between them, or in consequence of the degeneration of their contents, which then are of a yellow color and contrast with the gray tint of the rest. Rarely, the fibroid change which sometimes occurs is more advanced in the central than in the cortical portion of the gland, and then a distinction between the two parts is to be observed. Often irregular tracts of dense fibrous tissue pass in various directions. The glands do not usually present any fatty degeneration such as is so common in scrofulous affections. Here and there a gland may be found which has undergone caseation, wholly or in part. In one case, for instance, a gland in the groin was cheesy and softened, while all the other glands were firm, tough, and translucent. Occasionally many glands present this change, but such cases must be regarded as occupying an intermediate position between lymphadenosis and scrofula.

The softer glands yield juice on scraping. The firmer glands yield no juice. The harder glands are very firm and resist the knife. The section has a shining close aspect. This condition is common in cases of long duration and slow course.

When the capsule has been perforated, the gland presents a bulging, and at the bulged portions the tint is gray, and the capsule is obviously thinned or destroyed. The growth having perforated the capsule, invades any tissue or organ which may be adjacent.

Microscopical Structure.—The histological changes in the glands vary in different cases. In the smaller and softer glands the only recognizable change is an enormous increase in the cellular elements, the lymph corpuscles which lie in the meshes of the reticulum. The normal relations of structure, the relations between the septa and the follicles, and between the cortical and medullary substance of the gland, remain unchanged. Sometimes the growth of cells gradually invades the septa, which become split up and disappear. The substance of the gland then presents on section a uniform appearance. All parts present the structure usually seen within the follicles; leucocyte-like cells lie embedded in a moderately close network of interlacing delicate fibres and films, provided here and there with nuclei. This stroma can only be well seen on pencilling a section. Schultz believes that the delicate films of the stroma arise from the septa of the normal gland, split up and separated in various directions by the growth and accumulation of cells. Towards the hilus, where the vessels are larger, an infiltration of their outer coat with similar cells may be traced, and this infiltration may pass along the vessels to the exterior of the gland, and there extend in the adjacent fatty and cellular tissues. The new growth perforates the capsule by a process of progressive cellular infiltration, similar to that by which it invades the interfollicular septa.

The cells are round bodies, usually with single nucleolated nuclei, and resemble very closely ordinary lymph cells. Sometimes larger cells are seen. Occasionally, in the soft forms, a multiplication of the nuclei takes place, and many nucleated cells and even giant cells may be found, resembling those seen in myeloid tumors (Schmuziger). Similar cells may even be seen in harder forms (Langhans). Ollivier and Ranvier assert that some of these larger cells provided with one or two nuclei possess a diffuse coloring matter.

In the glands which are firmer there is a larger amount of fibroid tissue. In some cases this is mainly confined to the interfollicular septa, but it usually involves also the recticulum, the meshes of which become greatly increased in thickness: they may be homogeneous or have an obscurely fibrous aspect. They may be so abundant as to separate the individual cells. The thickening of the reticulum is greatest in the neighborhood of the vessels, both large and small. The capillaries may have their walls considerably thickened, and have a homogeneous or longitudinally striated appearance. The septa then cease to be distinguishable from the follicles. Ultimately many cells perish, and the fibroid transformation may be so complete that very few cells are to be seen on section of the gland, only here and there a group or series of small round cells lying between the fibres. The latter may be broad, wavy, and present a hyaline or "vitreous" appearance. These vitreous fibres may be arranged concentrically around the vessels.

In addition to the nuclei at the junction of the fibres of the stroma, fusiform cells are sometimes seen mingled with the reticulum. According to Virchow, round granular bodies may occasionally be found which are globes of nuclei of epithelial appearance, sometimes with many nucleated giant cells. It is probable that these arise in the same manner as that which the writer has traced in the growth of "nested sarcomas."[1] Virchow has remarked that in one case of hard glandular enlargements, the vessels presented

[1] Med.-Chir. Trans. 1876.

an amyloid degeneration of the walls.[1] There are few instances of amyloid degeneration of the glands on record.

The histological varieties may be thus summarized :—

1. A soft cellular growth of early and rapid enlargement, breaking up the septa by infiltration, and converting the gland into a uniform soft cellular mass, in which no distinction of cortical and medullary substance is perceptible.

2. A mixed cellular and fibrous change in which the cells are still abundant, but the reticulum is also thicker, and the septa, instead of being broken up, are also thicker than normal. The cells between the fibres are apt to undergo degeneration.

3. A more advanced fibroid change in which few cells are visible, but the whole gland is transformed into a dense network of broad fibres more or less uniform in appearance, with a thickened capsule.

Lymphatic Vessels.—There is little direct evidence of the implication of the lymphatic vessels in the morbid process. Those of the mesentery were observed in one case to be dilated. It is possible that the growth may sometimes spread along these vessels, since in other organs there is strong evidence that it may be located in structures with which the lymphatic vessels are connected. Hodgkin remarked that in one case the absorbents connected with some of the glands appeared to contain a bloody fluid. Such an appearance may have been produced by hemorrhage into the gland. Wunderlich found the lymphatic vessels from a diseased gland enlarged and distended with a clear fluid. In other cases, however, all attempts to discover or inject the lymphatics of the glands have been fruitless, and it is assumed that they may have been destroyed.

ORGANS.—Spleen.—In a large proportion of the cases the spleen is diseased. Out of ninety-five post-mortem examinations in which the state of the spleen is mentioned, it is said to have been normal in about one-fifth (twenty cases), while in the remaining seventy-five cases it was more or less diseased, in almost all of them enlarged. The degree of enlargement varies in different cases, being in some instances slight, in most moderate, in a few great. The organ attains a large size much less frequently than in splenic leucocythæmia. It seldom exceeds ten inches in length, and is more frequently from six to eight inches long, the average length of the healthy spleen being taken at five inches. The weight of the spleen is, as a rule, increased in proportion to the increase in size, and reaches from 10 to 30 ozs., rarely exceeding the latter. In a few cases the spleen has reached an extreme size.

The cause of the enlargement is, in a minority of the cases, a "simple hypertrophy," similar to that found in splenic leucocythæmia. In the majority it is due to the presence of disseminated growths, in the form of minute spots, or larger nodules and masses. Out of the seventy-five cases in which the spleen was enlarged, growths in the organ existed in fifty-six : in the remaining nineteen cases the organ was stated to be simply hypertrophied, or else to be "enlarged," any special cause of enlargement not being mentioned.

The enlargement of the organ due to the disseminated growths is rarely extreme. In some it was slight, and in a few, growths existed in a spleen of normal size.[1] In a few the enlargement was very great. In the majority of the cases in which the weight is given it has varied between one and two pounds. In only a few cases was this weight exceeded, and in two of these an enormous size was attained, the spleen weighing respectively seven[2] and nine-and-a-half[3] pounds. The surface may be uneven from the projection of the nodules of growth. The growths are in some cases small in size, visible as round pale spots, the size of peas, in the darker splenic pulp, and apparently seated in the Malpighian bodies. In most cases the growths are larger and more or less irregular in shape, frequently angular, and attaining the size of a pea, a hazel-nut, or walnut. The growths are grayish-white or yellowish-white, and more or less opaque. They were compared by Dr. Hodgkin to masses of suet, by others to bacon-fat run into the organ. They are commonly not surrounded by any capsule, but around the larger growths the splenic tissue may be compressed. They are usually firmer than the splenic tissue, and are sometimes very hard. Their consistence may correspond with that of the glands in the same case. These angular masses of growth rarely present softening or degeneration, unless many nodules are aggregated together into a large mass, when some local softening may occur. The spleen sometimes contains small round nodules the size of peas, more opaque and yellow than the irregular growths, and these occasionally soften. The spleen then resembles very closely the appearance sometimes presented in tuberculous disease. The growths have been observed, although

[1] Krankhaften Geschwülste, vol. ii. p. 618.

[1] In a case recorded by Dr. Strangeways Hounsell, of general gland disease in a lad of 14, the spleen contained nodules, and weighed only 3½ ozs. But the case was, in some respects, closely allied to scrofulous disease.

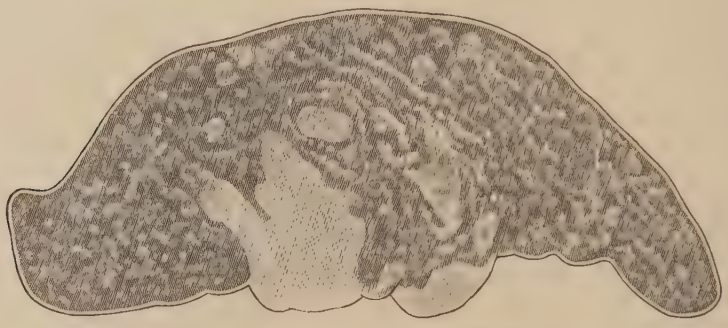
[2] Schultz, loc. cit. Case 6.

[3] Wunderlich, Arch. der Heilkunde, 1866, p. 535.

very rarely, to invade the capsule. The splenic pulp may be normal in quantity, or may be atrophied and reduced to narrow tracts between the nodules of growth.

The spleen, when simply hypertrophied in this disease, attains on an average a somewhat larger size than when it is the seat of the disseminated growths. Its consistence varies: it is usually firm, sometimes hard, rarely soft. The Malpighian bodies are often conspicuous, especially in the slighter degrees of enlargement, when they are often slightly enlarged and visible as paler gray spots. It is probable that these are the early stage of the disseminated growths, for between the two, in different cases, every gradation may be traced.

Fig. 78.



Spleen in Hodgkin's Disease, after Virchow.

Besides the disseminated angular growths, wedge-shaped infarctions may be observed, similar to those seen so often in leucocythæmia. They are commonly situated on the surface, the base of the wedge being adjacent to the capsule. When recent they are red, often the seat of extravasation, and surrounded by a zone of intense congestion. When of older date, they are paler red, granular in aspect, and ultimately become yellowish-white and opaque. The resemblance in the naked eye characters between the angular growths and these areas of infarction is close, and each condition has been repeatedly mistaken for the other. These infarctions are distinguished from the larger masses of growth by the congestion in the early stage, by their situation, the relation to the surface, and their greater opacity.

The spleen, enlarged from whatever cause, frequently contracts adhesions to adjacent organs, especially to the diaphragm and liver. The capsule is also often thickened by the same chronic inflammation which causes the adhesions.

Microscopical Structure.—The growths in the spleen resemble closely the growth in the lymphatic glands. They consist of the same minute cells lying in the meshes of a reticulum, identical in appearance with that of the lymphatic glands. The large, many-nucleated cells found in the glands, are rarely seen in the spleen.[1] There is often an abundance of imperfectly formed fibrous tissue, forming thick vitreous-like bands. Spindle-shaped cells connected with the reticulum are not infrequent. In the smaller growths the new tissue can often be seen to be connected with the walls of the vessels, and to spread along them. The limitation of the growths in the Malpighian bodies from the adjacent splenic pulp is, under the microscope, less distinct than it appears to the naked eye, but may commonly be brought out sharply by staining and recognized by the relation to the vessels. Sometimes the tissue of the pulp is compressed in the vicinity of the growth, and may contain much brownish-red pigment. The trabeculæ of the spleen may be infiltrated with lymphoid cells, which may also invade the walls of the vessels, especially the veins. The structure of the pulp is otherwise normal; it may present an appearance of atrophy from compression; the cells may be scanty, and the trabeculæ thickened, or it may present the same over-growth seen in splenic leucocythæmia. In one case recorded by Schmuziger, there appeared to be an enormous increase in the trabeculæ of the pulp.

Lardaceous degeneration is rarely observed in the spleen. In one case I found this degeneration in the Malpighian bodies, and not in the glands. In another case some of the smaller growths in the spleen, evidently originating in the Malpighian follicles, presented this degeneration, while the larger growths did not. A similar degeneration in the vessels of the spleen was found by Huttenbrenner in a case in which it was also present in the vessels of the glands and kidneys.

[1] An instance of their occurrence is recorded by Langhans. Virchow's Archiv, vol. liv. 1872, p. 513.

The medulla of bones may present a change similar to that met with in some cases of splenic leucocythæmia and pernicious anæmia. Softening of the bones was noticed in this affection by Perrin,[1] as long ago as 1861, in a case in which the ribs could be cut through with a scalpel, and the least pressure caused their fracture. The marrow is converted into a reddish-gray semi-diffluent substance. The change has been observed in the ribs, sternum, vertebræ, femur, tibiæ, and cranial bones. It has been found in cases in which there was a slight excess of pale corpuscles in the blood, and also in cases in which there was no such excess. It is not possible at present to say with what frequency the medulla is affected. It has been examined in several cases and found normal.

Under the microscope the altered medulla presents abundant lymphoid cells, and rather larger cells with very large nucleolated nuclei. In a section of bone, hardened and decalcified (with picric or chromic acid) these cells are seen to cram the enlarged spaces of the bone, and by pencilling, a reticulum may be traced, the trabeculæ of which are connected with the walls of capillaries (Kelsch). Thus there is a substitution of adenoid tissue for the normal elements of the medulla.

Alimentary Canal. — The numerous minute collections of adenoid tissue in the alimentary canal very frequently become the seats of morbid growths of similar tissue in cases in which the affection of the glands is widely spread, and occasionally in cases in which the glandular disease is slight. The mucous membrane of the mouth and the gums may present traces of inflammation, swelling, and ulceration, especially in the later stages of the disease. In the follicles on the posterior part of the tongue there may be a considerable overgrowth of tissue, rendering them unduly prominent.

The tonsils are occasionally enlarged by a similar growth of the adenoid tissue, which composes so large a proportion of their mass. The enlargement commonly affects both tonsils, less frequently one only. Occasionally the tissue may degenerate, and ulceration occur. Such ulceration is usually unilateral. One tonsil has been observed to be of an enormous size, and the other to have ulcerated away.[1] A lymphoid growth occupied the soft palate in a case recorded by Mulder.

Glandular overgrowth may occur in the mucous membrane of the pharynx. Occasionally, behind the pharynx, extensive growths occur, which may involve the pharyngeal wall and cause degeneration of its muscular fibres.

Growths in the œsophagus have been observed in several cases. The mucous membrane has been found thickly studded with minute new formations of lymphatic tissue, each about the size of a poppy-seed.[2] In one case there was extensive infiltration of the mucous membrane by a similar growth, in places breaking down into ulcers, and closely resembling that which is occasionally seen in the stomach.[3]

In the stomach, the lymphoid tissue, which exists beneath and between the glands of the mucous membrane, sometimes undergoes extensive hyperplasia, so as to cause irregular thickening of the mucous membrane, even over its entire surface. In a case described by Cruveilhier these growths constituted large thick rolls, resembling in size the cerebral convolutions. The growth here is always soft, and on section yields an abundant juice. It may break down and ulcerate, causing many small round ulcers.

When there is an extensive development of adenoid growth in the stomach, the upper part of the duodenum is usually affected in a similar manner.

Throughout the intestines the collections of lymphoid tissue in the solitary glands and Peyer's patches often undergo great enlargement from the growth of similar tissue. The enlargement of both sets of glands may be most considerable, as in typhoid fever, in the lower part of the ileum, and may extend into the commencement of the ascending colon. Occasionally the solitary follicles are alone considerably enlarged throughout the small and large intestines.

The growth of adenoid tissue, commencing in the follicular glands, often extends beyond their limits, and then its original relation to the glands may be obscured. Schultz indeed asserts that the growth is entirely a new formation, before which the original lymphatic tissue perishes, and that the new and the old can always be distinguished in the early stage of the growth by the deeper staining with carmine of the new portion. The growth may extend from the lymphatic follicles widely in the mucous tissue.

[1] Perrin, Bull. de la Soc. Anatomique, 1861, p. 247. Other cases are recorded by Kottmann, Inaug. Diss. Bern. 1871, and Schmidt's Jahrbuch, 1872, vol. clv. p. 327 (Case 4); Kelsch, Bull. de la Soc. Anat. 1873; Ponfick, Virchow's Archiv, vol. l. p. 550; Schultz, Archiv der Heilkunde, 1874, p. 200 (Case 1); Schmuziger, ibid. 1876, p. 279.

[1] Wickham Legg, St. Bartholomew's Hosp. Reports, vol. xi. p. 70.

[2] Chvostek, Allg. Wien. Med. Zeitung, 1877.

[3] Greenfield, Path. Trans. 1876, p. 275.

Occasionally nodules appear in the mucous membrane unconnected with the follicular glands. The growth remains limited to the inner layer of the wall of the intestine, never invading the muscular coat. Schultz has observed that it may perforate the delicate layer of muscular fibres which exists beneath the glands, and may invade the villi of the intestine, spreading there, as elsewhere, along the outer coat of the arteries. The Lieberkühnian crypts may be pressed upon, and their epithelium undergo degeneration. The growth occasionally assumes a very extensive development, and leads to great thickening of the wall of the intestine, which does not however usually reduce the calibre of the bowel, a point to which Dr. Moxon has called especial attention.[1] A general infiltration of the wall, in a case recorded by Kelsch,[2] attained in places such a local development as to constitute actual tumors. Irregular ulcers had formed, one of which surrounded the intestine.

The mucous membrane of the rectum may be the seat of adenoid growth very similar to that seen in the stomach.

Liver.—In a considerable number of cases the liver is diseased. Increase in size has been observed in about one-quarter of the cases, but this does not represent the frequency with which the liver is affected. The most common change is the existence of scattered lymphoid growths, and these may exist without causing enlargement, and may not be discoverable on naked-eye examination. The growths are usually minute, varying in size from a pin's head to a small pea, and are grayish in tint. Their distinctness depends on their color and on the tint of the hepatic tissue.

Less commonly, nodules are met with of larger size and fewer in number, varying from the dimensions of a large pea to that of a hazel-nut or a bean, white and semi-opaque in appearance, resembling very closely those of the spleen. They are usually firmer than the smaller growths, and are occasionally very hard, even semi-cartilaginous in consistence. They are sometimes rounded, but more often irregular in outline.

Under the microscope the minute growths are seen to occupy, as a rule, the interlobular spaces in which the portal vessels lie, and thence they may send processes into the interior of the acini. In structure they consist of minute round cells, lying in a retiform stroma, such as constitute the lymphatic tissue elsewhere. According to Schultz the trabeculæ of the tissue can be resolved into delicate membranous films, nucleated, and often provided with ramifying stellate cells. In one case many spindle cells were seen in the hepatic growths, although those in the glands and spleen had the characteristic retiform stroma.[1] The liver-cells do not participate in the process, but perish before it, the acini being invaded by processes of growth which develop between the rows of liver-cells. Occasionally a layer of compressed liver-cells exists on the outer surface of the growth, and constitutes a sort of capsule. When the nodules are of large size and irregular, tracts of atrophied acini may intervene between them. The cells of the growth may infiltrate the walls of the portal veins, penetrating even to the intima, which may, according to Schultz, be transformed into a layer of spindle cells. The blood thus appears to pass in channels excavated in the new growth. A similar but slighter infiltration of the walls of the arteries may be seen, and more frequently still of the walls of the bile ducts.

In some cases, instead of disseminated nodules, a diffused growth occupies all the portal interlobular spaces, and is visible to the naked eye as fine white lines accompanying the portal vessels, and under the microscope as broad tracts of nucleated tissue. Sometimes minute nodules may be observed here and there. From these tracts of tissue extensions may take place into the substance of the acini between the rows of liver-cells, just as from the nodular growths. In a few instances a similar growth has been seen in the neighborhood of the hepatic vein. This diffused growth may be so abundant as to occupy, it has been estimated, one-third of the organ.[2]

Ranvier has pointed out that in some cases in which the liver is enlarged there are no growths, but merely a great distension of the capillaries with blood, even when the latter contains no excess of leucocytes. The two conditions of congestion and growth are occasionally conjoined, as in an instance related by Bohn,[3] in which the liver was enormously enlarged from passive congestion, and throughout were scattered numerous foci of lymphatic growth.

The new formations rarely exhibit degeneration. The increased consistence depends on a thickening of the retiform tissue, similar to that which occurs in the glands. Fatty degeneration in the centre of the new growths has, however, been occasionally observed. Lardaceous degeneration of the walls of the portal venules was found in one case by Schmuziger.

The liver tissue itself may be the seat

[1] Path. Trans. 1873.
[2] Bull. de la Soc. Anatom. 1873.

[1] Payne, Path. Trans. vol. xiv. 401.
[2] Wilks, Guy's Hosp. Reports, 1866, p. 61.
[3] Deut. Arch. für Klin. Med. 1869, p. 429.

of fatty degeneration, which, in several cases, has been very intense.

The *Pancreas* rarely contains lymphatic growths. In a case recorded by Dr. Caton,[1] a small tumor of adenoid structure proceeded from the anterior surface.

Kidney.—Adenoid growths, similar to those which occur in the liver, are met with in the kidney in a considerable number of cases. They are mentioned in fifteen autopsies out of seventy, but were probably present in a much larger number, since they are rarely conspicuous, and sometimes can be detected only by microscopical examination. The organs thus affected may be of normal size or enlarged. They are usually unduly pale, and the pallor and increased size are chiefly due to the state of the cortical portion. When the growths are visible to the naked eye, they usually vary in size from that of a mustard-seed to that of a pea, occasionally, but very rarely, attaining the size of a hazel-nut. In one case a kidney was the seat of a very large lymphomatous growth.[2] They are always pale, whitish-gray in tint, and when large are usually firmer than the kidney substance in which they lie.

The growths are most abundant in the cortex. They commence in the intertubular tissue, and consist of the same retiform stroma and corpuscles as have been already described. By their enlargement they compress the tubules, and may lead to atrophy of the epithelium at the part compressed. Pale wedge-shaped areas, due to infarction from vascular obstruction, may also be occasionally found.

The substance of the kidneys may be affected independently of the existence of growths. The most common appearance is that of parenchymatous degeneration, showing itself either as cloudy swelling or as the mottled or large white kidney. Amyloid degeneration was present in one case.[3] Uric acid concretions have been observed in a few cases.

The *Peritoneum* has been found inflamed over enlarged glands. In a few cases it has been the seat of lymphoid growths. These sometimes closely resemble tubercle, and have been regarded as such. But sometimes they are as large as peas, and consist of the characteristic retiform tissue. In a case recorded by Bohn such growths existed in the peritoneum over the liver and intestine; and in another case similar nodules were scattered over the surface of the stomach and colon. The omentum has also been observed to be set through with small nodules, which Langhans in one case found to surround the vessels, and to possess a structure identical with that of the glands. They were bounded by bundles of connective tissue.

The peritoneal cavity frequently contains fluid, as part of general dropsy, in consequence of lymphatic growth in the hilus of the liver obstructing the portal vein, or, less frequently, in consequence of the direct irritating influence of the process of lymphatic growth in the peritoneum.

The *Ovaries* are very rarely diseased. In one case a growth of considerable size was found in one ovary. In another case, beneath the capsules of the ovaries, were minute nodules, having a lymphoid structure, and precisely resembling similar growths in the lungs.[1]

Testicles.—Growths have been met with in the testicles in many cases, usually in one, and sometimes in both. They may begin in the epididymis and be confined to it, as in one of Dr. Hodgkin's cases, or they may invade the secreting substance of the organ. In one case, recorded by Schultz, without leucocytal excess, both testicles were enlarged to double the normal size, the enlargement being due to infiltration with soft growth, occupying about two-thirds of each organ.

The structure of the growth in the testicle is the same as that met with elsewhere. It has been traced by Schultz to pass from the corpus Highmori into the septula, and between the seminal tubules along the bloodvessels. The walls of the vessels gradually become changed and invaded by the growth, so that at last they cannot be recognized, and the blood seems to circulate in wall-less channels in the lymphoid tissue. The seminal tubules are pressed upon, and their walls invaded by the growth, the epithelium within them undergoing degeneration. When the growth reaches the tunica albuginea, the same process can be traced which has been described as occurring in the capsule of the lymphatic glands. The new growth contains many newly-formed vessels.

Supra-renal Bodies.—In a man, aged twenty-three, who died in University College Hospital (under the care of Dr. Wilson Fox), the glandular enlargement being general and great, the supra-renal bodies were large, firm on section, the medullary part was hard and light-colored, and in some places nodulated in the same manner as the rapidly growing lymphatic glands.

The *Thymus* gland is frequently involved, as already stated, by growth from glands in the anterior mediastinum. It is sometimes independently affected, and the growth from it may invade adjacent parts. The thymus has also been found

[1] British Med. Journal, August 20, 1870.
[2] Desnos and Barié, loc. cit.
[3] Schmuziger, loc. cit. p. 27.

[1] Hérard, L'Union Med. 1865, Nos. 90 and 91.

to be enlarged and separate from the enlarged glands.

The *Trachea* is not often diseased. In one case the mucous membrane was covered with minute growths the size of poppy-seeds. (Chvostek.)

The *Lungs* may be invaded directly by the growths in the bronchial glands, or may be the seat of disseminated new formations similar to those which are met with in other organs. The invasion of the root of the lungs from the glands takes place around the bronchi and around the vessels, and also, in some instances, by direct extension. The peri-bronchial connective tissue is believed to be part of the lymphatic system. The growth forms nodules, varying in size from a pea to a walnut, sharply limited from the lung tissue, grayish-white in color, and resembling exactly the appearance of the glands themselves.[1]

The disseminated growths which occur through the lung substance are pale, translucent or whitish gray, the size of mustard-seeds or larger, and are often mistaken for tubercles. They are commonly most abundant towards the hilus, especially when of some size. In other cases they are uniformly scattered, or may occur chiefly towards the base, or towards the surface of the lung. Some of these growths are surrounded by a zone of congestion, probably from the collateral congestion due to the destruction of some of the vessels. The adjacent congestion may go on to actual pneumonia. The growths rarely break down, certainly less frequently than do the growths which occur in leucocythæmia. In one case on record masses were found in both lungs, and in the upper lobe of one were cavities containing pus, but whether formed by the breaking down of growths was uncertain.[2] The growths are composed of the same lymphatic tissue as is met with elsewhere, and they commonly develop in the tissue which surrounds the smaller bronchi. In some cases true tubercle has been found in the lungs.

The lungs are rarely the seat of other parenchymatous changes. That which is most commonly found is œdema, occurring as part of general anasarca, and it is a not uncommon cause of death. Occasionally they present the signs of acute pneumonia. Rarely there is evidence of chronic pneumonia, such as occurs in phthisis, apical, caseating.

Pleura.—Small sub-pleural lymphoid growths are found in this disease, although rarely. Effusions of fluid may occur into one or both pleural cavities, commonly serous, but sometimes sanguinolent. Nodules of lymphoid growth have been occasionally observed in the substance of the diaphragm.[1]

The *Heart* is sometimes normal, but frequently it is small. Occasionally it exhibits intense fatty degeneration, as in other forms of extreme anæmia. In a few cases lymphoid growths have been observed in the substance or on the surface of the heart,[2] and in one case numerous growths existed beneath the endo- and peri-cardium. A growth originating in the thymus may extend over the whole anterior surface of the pericardium, and almost envelop the heart. Growths in the mediastinum may perforate and shape themselves to the contiguous part of the heart. Effusion into the pericardial sac is not unfrequent, and, like that in the pleura, is sometimes sanguinolent.

The *Brain* is rarely the seat of growths in these cases, although the structures about the brain occasionally present primary lymphadenoma. In a case recorded by Dr. Murchison, a small growth existed in the dura mater above the foramen magnum,[3] and small lymphoid tumors were found, in another case, above the foramen opticum.[4]

Retina.—In some cases of Hodgkin's disease, with excess of white corpuscles in the blood, changes in the retina have been observed similar to those in leucocythæmia splenica. They have not, however, been described in any case in which there was no leucocytal excess, and occur chiefly in the forms in which the spleen is the seat of overgrowth of pulp, as in splenic leucocythæmia.

The *Skin* may be invaded secondarily by the extension of growth from a lymphatic gland which has perforated the capsule. The papillæ of the cutis become infiltrated, the epidermis undergoes atrophy, and the glands are destroyed.

In rare cases subcutaneous nodules are observed. In one case such growths existed in front of the sternum. In other cases lymphoid tumors have been found in the substance of the cutis, the structure of which has been studied by Ranvier and Greenfield.[5] They consist of the same small cells and reticulate stroma, infiltrating the corium and the subcutaneous tissue and causing atrophy of the fat cells.

Symptoms.—The two chief elements in Hodgkin's disease, the glandular enlargement, and the state of the blood, cause the most important symptoms of the disease. Others result from the generalized

[1] Löschner, Aus dem Franz-Josef Kinderspitale in Prag, Theil ii. 1868, p. 237.

[1] Murchison; Schultz, Case 3.
[2] Ibid. Case 1.
[3] Path. Trans. vol. xxi. 1870, p. 372.
[4] Mosler, Virchow's Archiv, vol. lvi. 1872, p. 14.
[5] Path. Trans. vol. xxvii. 1876, p. 278.

changes in important organs. It has been seen that the pathological changes vary much in different cases; they are attended by corresponding variations in the symptoms.

Earliest Symptoms. — Enlargement of the superficial glands is present, at some period, in almost all cases, and, from its obtrusive character, is often noticed early, having been the first evidence of the affection in two-thirds of the cases, 52 out of 78, in which the early symptoms were carefully noted. In two-fifths of the cases (36 out of 78) the first glands to enlarge were those of the neck. In some of these cases the glands were situated in the posterior triangle; in others, below the jaw. Enlargement of the glands on one side may precede for a long time the affection of those on the opposite side, especially when the glands to enlarge are those in the posterior triangle. The affection of the submaxillary glands usually soon spreads to the opposite side. In a much smaller number of cases, about one-eleventh (7 in 78), the inguinal glands were the first to enlarge. Less frequent still is an initial enlargement of the axillary glands. The glands first affected may remain enlarged for a long time before others are involved. In one case, recorded by Boorgard, enlargement of the tonsils was the first symptom of a glandular affection ultimately general.

When the deeper glands of the somatic cavities are those most diseased, the indirect symptoms which their enlargement causes may precede the affection of the superficial glands. Pain in the chest and cough may be the earliest symptoms in cases of enlargement of the mediastinal glands; pain in the abdomen, when the retro-peritoneal glands are the first affected; pain in the thigh or sciatic nerve, or œdema of one leg, when the pelvic and iliac glands are earliest enlarged.

In another group of cases the first symptom depends, not on the glandular enlargement, but on the accompanying blood state; and pallor, weakness, and emaciation first attract attention. In women these are often accompanied with arrest of menstruation. Dyspnœa is a constant attendant on the anæmia, and cough is often associated with it. In one or two cases epistaxis was the earliest symptom, and in two stomatitis. In a few cases slight general œdema, without kidney disease, was the earliest evidence of the affection; and in three cases on record the disease declared itself by irregular febrile attacks, preceding any other symptoms. In some cases the onset is accompanied by a febrile attack resembling typhoid, but of longer duration. A remarkable case of this character is recorded by Bohn, in which, after fever with splenic enlargement had existed for a fortnight, an attack of suppurating tonsillitis appeared to be the exciting cause of enlargement of the glands at first under the jaw, followed in the course of a few weeks by that of all the glands of the body.[1] These constitutional symptoms frequently accompany an initial glandular enlargement, but they alone ushered in the malady in about one-sixth of the cases in which the onset was carefully noted.

Glands.—The superficial glands when enlarged are usually firm and smooth. At first, and for a long time, they are separate, movable on one another beneath the integument; and this limited mobility is a peculiar feature, and has been thought to be characteristic. In many cases ultimately the mobility ceases, the glands becoming adherent to one another by peri-adenitis, or, more commonly, in consequence of their union by invasive growth. They then constitute an irregular lobulated tumor of considerable size, which may, by the pressure it exerts, cause very troublesome local symptoms.

The glands are usually firm, especially when of small size, and their growth of slow progress. Occasionally it is rapid, and the glands are much softer, and sometimes semi-fluctuating. When this is the case, they may contain such an abundant quantity of lymph that, a puncture being made, there may be a constant flow of lymph from the opening.[2]

The enlargement of the glands is usually attended with no pain, except such as results from the pressure they exert. Even in rapid cases the growths are usually painless. Sometimes slight pain in the swellings has been complained of. Occasionally when there is sudden swelling of the glands from time to time, the rapid enlargement may be attended with considerable pain.

The enlarged glands may continue to increase to the last. Frequently, however, an arrest of growth, and even a remarkable diminution in the size of the glands, may occur before death. It may be so considerable that the enlargement apparently subsides.[3] In the remarkable case recorded by Bohn early splenic enlargement occurred, and most of the superficial glands were considerably enlarged for about six months, but subsided before death, and, post-mortem, only the retro-peritoneal glands were enlarged, the spleen being simply hypertrophied.

The enlargement of the cervical glands generally begins in the posterior triangle or in the submaxillary group. The size attained by each group is often consider-

[1] Deut. Arch. für Klin. Med. 1869, p. 429.

[2] Bonfils, Recueil des Travaux de la Soc. Méd. d'Observ. 1857–8, t. i. p. 157.

[3] Bohn, loc. cit.; Caton, British Med. Journ. August 20, 1870.

able, and the appearance of the patient may be strangely altered in consequence. The submaxillary glands may encircle the neck below the jaw, and the lower cervical glands may obliterate the neck and form a mass on which the head seems to rest as on the trunk. The enlargement may extend up to the mastoid process and parotid gland, and at the back of the neck the sub-occipital glands are also commonly enlarged. When the growth invades adjacent structures the substance of the thyroid may be involved. The more deeply-seated glands also enlarge and cause pressure effects, some of which have been mentioned in the section on Pathological Anatomy.

The pressure on the carotid arteries may so lessen the supply of blood to the brain as to cause cerebral anæmia. That on the veins may lead to the symptoms of passive cerebral congestion. Grave cerebral symptoms, coma, convulsions, &c., occur in some cases, and may be in part due to this pressure. The pneumogastric nerve is surrounded and compressed by the glandular growths, and sometimes this may be a cause of the cardiac irregularity and failure observed. The glandular growths may extend into the pharynx and fauces, and interfere with deglutition. Deafness is a very frequent symptom, and sometimes occurs early; it seems to be due to the pressure of the cervical and pharyngeal growths. The enlargement of the submaxillary glands may obstruct the movement of the lower jaw, and so interfere with mastication. The lateral displacement of the larynx may be such that, on laryngoscopic examination, one hyoid fossa may be invisible, while the other is wide open.

The trachea is frequently compressed by the glands, sometimes so as to lead to very serious interference with breathing, and even to death by suffocation. When the compressed portion is just below the larynx, tracheotomy may be necessary and practicable, although most difficult. Trousseau gives a graphic description of the difficulties of the operation of opening the trachea, surrounded as it is by masses of enlarged glands and displaced vessels.

The œsophagus may be compressed by the glands in the neck or the posterior mediastinum, and dysphagia result. Sometimes there may be complete obstruction, and death may occur in consequence of inability to take food.

The enlargement of the thoracic glands may give rise to the signs of intra-thoracic growth, described in the article on that subject—dulness behind the sternum, and sometimes bulging of the chest-wall, displacement of organs, and various other pressure signs. Among the symptoms thus produced, dyspnœa and cough are frequent, especially from the enlargement of the bronchial and cardiac glands. The difficulty in breathing is spasmodic, and often produced in part by pressure on the recurrent laryngeal. Spasmodic cough may be also troublesome. Pressure on the large vessels is not common, but now and then is caused by a glandular growth in the anterior or posterior mediastinum. The aorta rarely suffers, but the superior vena cava is occasionally compressed, and all the signs of obstruction to the return of blood from the head and arms, enlargement of veins and œdema, may result.

The axillary glands, when large, interfere with the movement of the arm, and may exert pressure on vessels and nerves, and cause so much pain in the arm as to make their removal a matter of necessity for the relief of the patient. Enlargement of the epitrochlear glands may press upon the ulnar nerve and occasion severe pain along its course. The inguinal glands often compress the femoral vein, causing great œdema of the limb, and sometimes leading to thrombosis.

The symptoms which result from the enlargement of the abdominal glands are various. When the glands attain a considerable size, they may be commonly felt through the walls of the abdomen. In consequence of the lax parietes, pressure effects are less frequent than in the case of the thoracic growths. The retro-peritoneal glands, by pressing on the inferior vena cava, may cause or increase the œdema of the legs. When large, they may, by pressure on the stomach, lead to vomiting. They rarely interfere with the lumbar nerves, although the pelvic glands may compress the branches of the sacral plexus, and cause sciatic pain. The solar plexus may be surrounded and inclosed in a mass of glands, and then symptoms of Addison's disease may be present (p. 535). The portal glands may obstruct both the bile duct and the portal vein, causing persistent jaundice and ascites.

Spleen. — The enlargement is rarely great and does not often cause early symptoms. In this respect lymphadenosis presents a remarkable contrast to splenic leucocythæmia, in which early and obtrusive splenic symptoms occur. Only in rare cases are there pains in the left hypochondrium, or any sense of abdominal fulness from the splenic tumor. Now and then the pains are considerable, and may radiate to the back, and the organ may be tender on pressure. Usually the enlargement is sufficient to enable the spleen to be readily felt, and in some cases the tumor which it forms may be so considerable as to extend to the middle line, and then there may be symptoms due to the bulk of the tumor, and which are described elsewhere. When the nodules of

growth are large, its surface may be perceptibly irregular. The spleen, like the glands, may lessen in size before death.

Liver.—The disseminated growths in the liver, if inconsiderable, cause no symptoms; when extensive, they may give rise to perceptible enlargement of the organ, rarely great, and commonly uniform, the growths not being so large as to cause any irregularity in its shape. They do not interfere noticeably with its functions. Even the infiltrating growth in the portal canals does not usually produce symptoms, probably because it rarely undergoes a fibroid change and causes little pressure. Jaundice, when present, is generally due to pressure of enlarged glands on the bile duct. Ascites is frequent, but is commonly to be ascribed to a similar cause, or is part of general anasarca. The dilatation of the veins of the liver, which is occasionally observed, no doubt assists in the production of portal congestion. The slight destruction of the liver-cells by the growth which infiltrates the acini, causes no recognizable symptoms—if any are produced, they are lost in those of the cachexia which is always present.

Kidneys.—The function of the kidneys, in most cases of lymphadenosis, is not materially deranged. In some cases the urine is dark and scanty. Few careful observations on its composition have been made. Dr. Wickham Legg found in one case a trace of indican reaction.

The disseminated growths in the organ may give rise to no symptoms, even when they are numerous. Sometimes, however, a trace of albumen is found in the urine, and now and then there are lymphoid cells resembling those of the growths in the kidney. Although the amount of albumen from the scattered growths is rarely considerable, albuminuria is not unfrequent from parenchymatous changes in the organ, but these must be regarded as complications.

Sexual Organs.—No symptoms can be referred to the rare growths in the sexual organs, ovaries and testicles, excepting the enlargement of the latter, which is perceptible on examination. When degeneration occurs in the new growth and the gland shrinks in consequence, the testicle may lessen in size to very small dimensions, as in a case under my own observation. No facts are on record concerning sexual power in the disease. It is probably only interfered with when the testicle becomes the seat of growth. In women amenorrhœa is common, and is often an early symptom. There are, however, many cases in which women have conceived and borne children after the affection has made some progress.

Alimentary Canal.—The development of lymphoid tissue in the various parts of the alimentary canal frequently gives rise to symptoms.

The stomatitis which has been already mentioned, is in some cases due to the development of lymphoid growths in the gums, in others it is the result of the blood cachexia. It may occur independently of any excess of white corpuscles in the blood. The gums may be swollen and pale from lymphoid growth, or they may be spongy and even gangrenous. Vesicles may form on the swollen gums, and the secretion from them, usually fetid, may be acid in reaction. Hemorrhages may occur beneath the mucous membrane.

No symptoms attend the enlargement of the follicles of the tongue, but that of the tonsils causes some difficulty in swallowing, rarely considerable unless pharyngeal growths coexist. It is probably by the interference of these growths with the function of the Eustachian tube, that the deafness so frequently noted is produced. The pharyngeal growths may cause troublesome dysphagia, both directly by their size, and indirectly by infiltrating the pharyngeal muscles, causing degeneration of the fibres, and consequently a muscular paralysis of the pharynx. In rare cases these growths may lead to complete obstruction, and consequently death by starvation.

The trifling œsophageal growths which have been noted in a few cases lead apparently to no symptoms. Œsophageal obstruction is always due to pressure of glands outside the tube.

The gastric function may be deranged in consequence of the local growths in the mucous membrane of the stomach, pressure from adjacent glands, or from the effect of the blood state. Loss of appetite, dyspepsia, and vomiting, are the chief symptoms of gastric growths. The vomiting is sometimes troublesome and persistent. When the growths ulcerate, the symptoms of gastric ulcer may be present, pain, tenderness, and hæmatemesis. The pain is less than that of simple ulcer. These symptoms may themselves lead to death. Very troublesome symptoms of dyspepsia with vomiting may result from the pressure on the stomach of the adjacent glands. In the commencement of the disease the appetite is usually undisturbed, although excessive hunger has been observed in young persons. In the later cachectic stage, anorexia is usually a prominent symptom.

The lymphoid growths in the intestines may be unattended by any indication of functional disturbance. In other cases there is long-continued and obstinate diarrhœa, sometimes accompanied with hemorrhage. Diarrhœa may be troublesome, when there are no intestinal growths. It is common towards the end, and occasionally is marked as an early

symptom. Even when the lymphoid growth is very extensive, the calibre of the bowel not being encroached on, no symptoms of obstruction result. Pressure on the intestines by a mass of enlarged glands outside it may lead to troublesome constipation, although rarely to actual obstruction. It is said, by Müller, that hemorrhage from the rectum may result from the same cause, external pressure.

Respiratory System.—Disturbances of the respiratory organs are very frequent. Dyspnœa, due to the blood state, and felt chiefly on exertion, is an almost constant symptom, and is present in some cases throughout the disease. The respiration is often frequent—24 to 36 per minute. Considerable and permanent dyspnœa is usually due to pressure on the trachea or bronchi, or to interference with the pneumogastric nerve or its recurrent branch. As in other cachectic states, bronchial catarrh is common, and increases the dyspnœa.

The growths in the lungs are not usually so extensive as to give rise to physical signs. When of rapid formation, and attended with vascular disturbance in their vicinity, râles may be heard in places through the lungs. In the rare cases in which softening occurs there may be the physical signs of excavation.

Pleural effusion is common, and may result from pressure on the azygos or bronchial veins. When due to actual pleurisy, it must be regarded rather as a complication than as one of the symptoms of the disease.

Circulatary System.—The heart's action is not usually interfered with by the pressure to which it is occasionally subjected; nor have any special symptoms been noted in the cases in which growths have been found post-mortem in the walls of the heart. Fatty degeneration, due to the anæmia, may lead to the signs of cardiac feebleness and even to occasional attacks of syncope. The heart's action is quickened in proportion to the amount of febrile disturbance which may be present. It may also be disturbed, as already mentioned, by pressure on the pneumogastric.

Blood.—The anæmia is one of the most conspicuous features of the disease. It may be the earliest symptom, or the glandular enlargement may occur and advance before any signs of deficient blood-formation present themselves. We are able to estimate the amount and progress of the anæmia by means of the hæmacytometer, and may thus probably demonstrate its presence in all cases in which other symptoms of the disease are present. In patients with this disease in whom the face was well colored, I have found the corpuscles reduced to sixty per cent. of the normal. In some cases there are many small red corpuscles.

In the majority of cases there is no excess of white corpuscles in the blood. In a minority of cases there is an excess, slight or considerable. Out of sixty-four cases in which the blood was examined by the microscope, there was no excess of white corpuscles in thirty-nine. In the twenty-five cases there was an excess, which in nineteen was moderate, in three was slight. In three others there was no excess of leucocytes during the early period of the case, but a slight excess was present during its later stages. The white corpuscles are as a rule small, corresponding with the description originally given by Virchow of their appearance in "lymphatic leukæmia." To this rule, exceptions are, however, occasionally met with. The cells are in many cases of different sizes; and when the excess is moderate, to ten or twenty times the average, the corpuscles may be of normal size. In most cases in which the increase was considerable it has been vaguely described, but in some it has been definitely stated. It very rarely, however, reaches a degree comparable to that which is frequent in splenic leucocythæmia [1] In many of these cases the spleen was enlarged. To this point further reference is made in the section on Pathology.

The blood when drawn is strikingly pale, and has been compared to diluted

[1] Of the cases of primary gland disease in which the spleen was not enlarged, and a considerable excess of leucocytes was present in the blood, one of the most extreme examples is that recorded by Virchow as "lymphatic leukæmia" in which the blood in the heart was thought to be pus. Other cases with a spleen of normal size are described by Mulder, in which greenish white clots, post-mortem, consisted almost entirely of white cells, by Dr. Strangeways Hounsell, in which during life there was one white to fifteen red, and the spleen, post-mortem, weighed only 3½ ozs., and by Dr. Ward, in which 200 white corpuscles were present in each field of the microscope. Cases with a "great increase" observed during life, and normal spleen, have been recorded by Kottmann, Hughes Bennett, and McCall Anderson. In a case of extreme gland growth, recorded by Vigier, in a man aged 53, with a spleen six inches long, the proportion during life was one white to four or five red. With overgrowth of splenic pulp, and no conspicuous growths, cases with one white to four red have been recorded by Cuyrium and by myself, and cases of "considerable increase" by several observers. In a case of typical Hodgkin's disease, in which the spleen contained conspicuous growths, a proportion of one white to three or four red was found during life by Ollivier and Ranvier, and in another "extreme excess," post-mortem, by Potain and Chaillou. Cases of slighter but considerable excess have been recorded by Mosler, Pouffard, Schmuziger, and others.

claret. Except in the rare cases in which the leucocytes are in great excess, it has not the opaque appearance of leucocythæmia. After death it coagulates slowly and imperfectly.

The anæmia causes dyspnœa on exertion, due to the diminished number of oxygen-carriers in the blood. Languor and muscular weakness are marked. Other disturbances of the circulation also result from the anæmia. Œdema of the feet is common, and there may even be general anasarca from the same cause. Subcutaneous extravasations in the legs may occur, and hemorrhages, especially from the nose, are frequent, but far less so in this disease than in splenic leucocythæmia. The occurrence of hemorrhage may be independent of any increase in the white corpuscles of the blood.

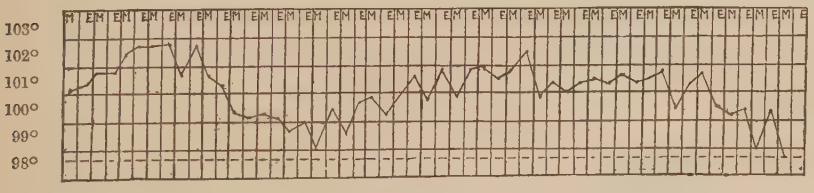
The anæmia, and the emaciation which is probably to a large extent dependent on it, and the accompanying weakness and malaise, constitute what has been termed the "cachexia" of the disease. It is only absent in cases which terminate at a very early period from some accidental cause.

Nervous System. — The ill-nourished brain may present various evidences of weakness; depression of spirits, languor, and, in women, hysterical phenomena. The pupils may be unequal, from pressure on the sympathetic in the neck. In a few cases very remarkable nervous symptoms occur in the course of the disease, especially towards the close. These are delirium, coma, and epileptiform convulsions.[1] When death has occurred, no pathological condition has been discovered to which the symptoms could be referred. They occur independently of increase in the white corpuscles.

Skin.—Pallor of surface is almost invariable when the disease is advanced, and it sometimes exists from the first. There is a corresponding pallor of the mucous membrane. There is often anasarca, and then the appearance may resemble that of Bright's disease. The skin may be dry during the febrile paroxysms, but in many cases it is moist, and in some cases there is copious perspiration. The occasional occurrence of bronzing of the skin has been already mentioned. Certain skin diseases are not uncommon during the cachectic period, especially a papular rash upon the backs of the forearms and hands, furuncles, and pemphigus.

Temperature.—Fever, occasional or constant, is a frequent but not invariable symptoms of the disease. It is present in two-thirds of the cases. Out of forty cases in which the presence or absence of pyrexia was carefully noted, it was absent or present only during some final intercurrent inflammation, in thirteen cases, while twenty-seven cases presented elevation of temperature as part of the special disease. It is not easy to say, from examination of cases, on what the occurrence of pyrexia depends. It is not associated with any uniformity, either with the duration of the disease, or with its diffusion. Pyrexia is a little more frequent in acute than in chronic cases, but to this rule there are some striking exceptions. Age, however, has a distinct influence on the febrile character of the affection. In almost all cases of lymphadenosis under twenty years of age there is fever. Nine cases of the forty cases were under twenty years of age, and in eight there was pyrexia. Thirty-one cases were over twenty, and the temperature

Fig. 79.



Temperature in Hodgkin's Disease. Continuous pyrexia.

was found to be normal in twelve and raised in thirteen.

The pyrexia exists at the commencement of the disease, chiefly in cases which begin with general swelling of the glands. Its characters in different cases vary much, and its course is commonly irregular. Three types may, however, be recognized. In one the temperature is continuously raised, presenting very slight diurnal variations of a degree or a degree and a half. The highest temperature is sometimes in the morning, sometimes in the evening. Occasionally the temperature may descend to the normal, and rise again. The degree of elevation is usually from 100° to 103°. (Fig. 79.)

A second type is characterized by periods of pyrexia, in which for several days a high temperature is maintained,

[1] Southey, loc. cit.

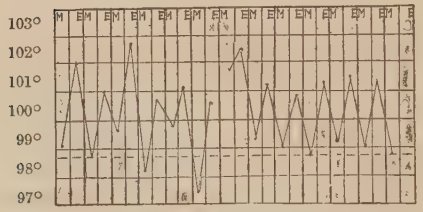
the daily variation being slight. Alternating with these pyrexial periods are intervals of several days in which the temperature is normal or nearly so. The height attained by the fever may be considerable, sometimes reaching 105°, as in the case from which a chart is given. (Fig. 80.)

Fig. 80.

Temperature in Hodgkin's Disease: Alternating pyrexia.

A third type is characterized by morning remissions, the temperature being always higher in the evening than in the morning. The daily variations are from one to three degrees, the morning temperature being at or below 100°, sometimes normal, and the evening temperature being from 101°–103°, as in Fig. 81.

Fig. 81.



Temperature in Hodgkin's Disease: Remitting pyrexia.[1]

The same case may present at various times different types of pyrexia. In some the febrile periods are rare, in others pyrexia is the rule, and the intervals of normal temperature are the exception. Sometimes the pyrexial periods coincide with a rapid increase in the size of the glands.

Complications.—The chief complications of lymphadenosis are (1) those which result from the pressure produced by the enlarged glands; (2) intercurrent affections of certain organs; (3) certain diseases resulting from the profound anæmia which is frequent; (4) some general diseases, perhaps indirectly connected with the glandular overgrowth, although not necessarily associated with it, of which the chief is tuberculosis.

(1) *The Pressure Effects* of the glandular enlargements have been already discussed in considering the symptoms of the disease. Now and then their effects are so considerable, and run a course so independent as to deserve the name of "complications." Such are the thrombosis in the veins of the limbs, and the pleural and pericardial effusion, and the rare bronzing of the skin from disease of the solar plexus.

(2) *Intercurrent Affections.*—The kidneys are occasionally the seat of parenchymatous degeneration, accompanied by albuminuria, and the other signs of Bright's disease. The occurrence of the change is apparently not necessarily related to the existence of growths in the organ, although the tendency of the scattered growths is to cause local degeneration. The kidney affection is usually insidious in onset, resembling rather a subacute than an acute change. Casts occur in the urine and sometimes present evidences of fatty degeneration. In one case which I have recorded the degeneration was possibly aided by the administration of phosphorus, but a similar degeneration has been met with in other cases in which no phosphorus was given.

Pneumonia is an occasional complication of the later stage of lymphadenosis, and when it occurs is usually fatal. Local pneumonia may accompany lymphoid growths, and in a few cases a caseating pneumonia has given rise to the slighter signs of phthisis. Tubercles have been found in the lungs in a few cases, but they occur only at the end of the disease, and give rise to no symptoms. Pleurisy is common towards the last, and the effusion is often great. It is apparently due in part to passive congestion, and in part to the cachectic state of the patient. Pericarditis has also been observed. Both are occasionally secondary to local growth.

Fatty degeneration of the heart and of

[1] These charts are from cases in University College Hospital, under the care of Dr. Wilson Fox.

the liver are not unfrequent and may give rise to their own symptoms.

The jaundice and ascites which may result from portal obstruction have been already described.

(3) *Effects of the Anæmia.*—The anæmia and cachexia may lead to certain complications. Erysipelas sometimes occurs, especially in the parts the seat of œdema. Purpuric spots occur in the skin. Superficial abscesses sometimes form on the legs. Pemphigus has occurred in one or two cases, and in others there were troublesome boils; in one case at least a hundred in succession, followed by a papillary skin eruption.

(4) *Certain general diseases* sometimes accompany lymphadenosis and mixed affections result; one of these is tuberculosis. A more frequent but still rare accompaniment is scrofula. The characteristic of scrofulous affection is the tendency of the new formation to caseate, soften, and break down, and this tendency may be seen in either glands or spleen. The case described by Morgagni (note, p. 529) is an instance in which the distribution of lymphadenosis was combined with the anatomical characters of scrofula. In other cases some glands present the cheesy scrofulous aspect, while others have the characteristic appearance of lymphadenoma. In others again, the glands have the hard glistening appearance of lymphadenoma, while the new growths in the spleen caseate, and soften.

COURSE AND DURATION.—The onset of the affection varies in different cases. In one group the general glandular enlargement is preceded for a long time, it may be for years, by local glandular swellings. In another the affection begins with a simultaneous enlargement of all, or nearly all, the glands in the body. Subsequently the evidences of impaired general health and nutrition are developed. Three stages have been proposed by Ollivier and Ranvier. The first is that of the early development of local gland-change, the second that of the generalization of the affection, and the third that of the cachexia. It is to be noted, however, that the relative order differs in particular cases, and even the evidences of these as distinct stages cannot always be recognized. Occasionally the disease remains, for many years, limited to the glands first affected. In a case recorded by Jaccoud[1] an initial enlargement of glands in one axilla was followed almost immediately by those on the opposite axilla. Shortly afterwards, the enlargement of the latter lessened and disappeared, the glands first affected lessened in size and remained stationary for nine years; at the end of that time rapid generalization occurred. I have a patient now under treatment in whom the first glands enlarged, in the right axilla, ten years ago, and were excised four years ago by Mr. Heath. Since then the glands in the right side of the neck have enlarged, but no others. The early latent period may, on the other hand, be entirely absent. The evidence of general anæmia, may precede all the other symptoms of disease, or it may accompany the early local development of the affection. It is, however, progressive in character, and most pronounced towards the end.

The duration of lymphadenosis varies from three or four months to several years. The commencement of the affection can often be fixed with difficulty. On this account it is probable that some of the shorter cases are really of longer duration than they appear.

The duration of fifty fatal cases in which it could be fixed with some accuracy is given in the following table:—

Less than 1 year,			in	18	cases.
Between 1 and 2 years			in	15	"
"	2	" 3	"	6	"
"	3	" 4	"	6	"
"	4	" 5	"	3	"
Over 5 years,				1	case.

The average duration of the whole fifty cases was nineteen months. Two-thirds of the cases terminated in less than two years. In a few instances the disease appeared to have lasted for more than four years, but these are cases in which a local glandular enlargement preceded for many years the general affection. If this period of slight local glandular enlargement were included in the duration of all cases in which it occurs, I believe the average duration would be much longer than is given above.

It is probable that this number of cases is too small to furnish any trustworthy evidence of the influence of age in the duration of the affection. As far as it goes it shows that the duration is nearly the same during the first half of life, and that in late life it becomes shorter. Thus in the following table the maximum, minimum, and average duration in months in each decade is given, and the number of cases on which the calculation is founded:—

[1] Leçons de Clinique Médicale, p. 10.

Age at Commencement.	Cases.	Minimum.	Maximum.	Average.
1—10	9	4	36	19
10—20	9	3	54	18
20—30	9	6	42	18
30—40	11	4	48	22
40—50	2	18	60	—
50—60	7	8	24	14
60—70	3	6	8	7

The duration of lymphadenosis appears also to be little influenced by sex. The average duration of thirty-five male cases was just eighteen months, and that of eleven female cases nineteen months.

A few cases are on record[1] in which general swelling of glands and spleen, accompanied with a great excess of white corpuscles in the blood (in one case 1 white to 3 red), ran a rapid course, ending in death in a few weeks. They can hardly be classed with ordinary cases of Hodgkin's disease.

Termination.—Asthenia is the most common cause of death. The anæmia progresses, the patient becomes gradually weaker, more prostrate, anasarca occurs, the minor disturbances which attend a progressive cachexia increase, until at last the patient sinks, worn out. In a considerable number of cases death occurs in consequence of some accidental result of the morbid process. Of these the most common is asphyxia from pressure of the enlarged glands upon the trachea or bronchi, increased, in some instances, by laryngeal paralysis from pressure on the nerves. In eight recorded cases asphyxia was the cause of death. In a few cases the pressure upon the œsophagus has caused death by starvation. In one case, the instance communicated by Sir Robert Carswell to Dr. Hodgkin, the same result followed the occlusion of the pharynx by growths. Hemorrhage from the mouth and nose was the cause of death in one case. Diarrhœa, although it often lessens the patient's strength, is recorded as the actual cause of death far less frequently than in splenic leucocythæmia. In a few cases death has occurred from cerebral disturbance, the nature of which is uncertain, manifested by coma, delirium, and convulsions, without discoverable pathological cause. Attention has been called to this circumstance by Dr. Southey, but it is certainly not so frequent as the number of instances met with by him would suggest.

In many cases death occurs from some intercurrent affection. Pneumonia is one of the complications most frequently fatal. Œdema of the lungs is common, and frequently assists other causes, especially pleural effusion, in bringing about the end. Pleural effusion is very common towards the last, but is not alone a frequent cause of death. Rarer fatal complications are peritonitis, diphtheria, and kidney disease.

[1] Paterson, Edin. Med. Journ. 1870; Ponfick, Virchow's Arch. 1872, Bd. 56.

PATHOLOGY.—The changes in the lymphatic glands are allied to two morbid processes, inflammation and growth, so often, under various circumstances, combined. In some cases, the exciting causes of the disease, appear to act by inducing a process of inflammatory irritation, and the alteration in the glands may be the same as attends such a process. More frequently, however, such exciting cause is not to be traced, and the structural change has the character of that independent and progressive tissue formation which we term a "growth."

An attempt to assign the disease a position, according to the features of the growth which characterizes it, is met at once by a new difficulty, resulting from the contrast which is presented by its clinical history and anatomical characters. Structurally, the growth is homoplastic, differing, it is true, from the normal structure of the glands, but differing sometimes little, and always by gradations, from the structure of glands which are enlarged under the influence of simple irritation, recent or remote.[1] Clinically, the disease has the character of malignancy, attaining a wider extension than any other morbid growth, not excluding tubercle itself, and attended by constitutional symptoms, as striking as those of cancer. This contrast, and the difficulties which it involves, were clearly recognized by Craigie, and we cannot wonder that he admitted that the word "cancer" accurately describes its clinical character, or that one of the latest writers on the disease finds in the term "desmoid carcinoma" its most accurate designation. The opinion which seems to harmonize best with the facts is that which has been advocated by Dr. Wilks, who assigns to the disease a position intermediate between cancer and tubercle, the change in the glands being similar to cancer in its clinical and naked-eye characters, and the dissemination of the growth, the affection of some of the internal organs, and the pyrexia of many cases, resembling the characters of tubercular disease.

The question whether the disease is primarily general or local has also been much discussed. Dr. Wilks pointed to

[1] Burdon-Sanderson, Path. Trans. 1870.

the wide-spread distribution of the affection as evidence of a preceding blood-disease. Wunderlich also urged that it must be regarded as a disease of constitutional origin, a general disturbance of the lymphatic system. The same view has been advocated by Müller and Schultz. On the other hand, Trousseau laid stress on the fact that the disease is, in some cases, distinctly started by a local irritation, and he believed that it is, in the first instance, a local affection, and that its subsequent development is a rapid generalization. But this theory is not applicable to cases in which many groups of glands enlarge together without discoverable exciting cause. The characters of the disease certainly suggest that it is due, in all cases, to both constitutional and local causes, and that the extent of the two elements differs in different cases.

The general condition underlying the anatomical changes has been supposed to be an alteration of the blood, and the early anæmia and considerable pyrexia of some cases lend support to the view. But in most instances indications of a preceding blood-change are absent, and the general condition may be better conceived as a primary condition of the lymphatic tissues rather than of the blood. The assumption of such a predisposition is necessary to explain not only the cases which present a simultaneous affection of all the glands, but also the character of an initial local glandular enlargement, by which it persists in its special form. On the other hand, the hypothesis of an infective element in the primary local disease is hardly compatible with the phenomena of some of the cases for which it is especially needed, in which a local swelling exists for many years in a stationary state before any indications of generalization present themselves.

But the theory of infection cannot be summarily dismissed, because we must infer also the existence of a special predisposition to the disease, affecting both the glands first enlarged and those subsequently diseased. It is conceivable, and the phenomena of some cases suggest, that the two processes may both take part in the development of the disease. There may be an infection of predisposed tissues. Such double influence may have been at work in the remarkable case recorded by Bohn, in which a febrile attack with splenic enlargement preceded for a fortnight the glandular swelling, and the latter was apparently excited by a tonsillitis, the submaxillary glands being first affected, and afterwards, in the course of a few weeks, all the glands of the body.

The process of infection must be conceived as a contamination of the blood, since the generalization is to glands and lymphatic structures out of the course of the lymph stream from the glands primarily affected. But the theory of infection, if accepted, is of limited application to the phenomena of generalization. The localization of the secondary growths is not that of most secondary tumors, and requires the assumption of a predisposition of the lymphatic tissues.

It is thus necessary, in order to explain the phenomena of Hodgkin's disease, to assume the existence of a general dyscrasia, affecting the lymphatic tissues, of different intensity and different operation in different cases, but existing in all. We must regard the affection as primarily constitutional, with local growths as the result of that general state, which are determined often by local causes. The local growth has received the name of lymphadenoma, and to the general disease, in these articles, the name lymphadenosis is applied. The closest alliance of the affection is thus with other diseases, especially tuberculosis, which are distinctly constitutional, and have, as their anatomical character, disseminated local growths, the occurrence of which is also distinctly influenced by local causes.

There are, however, certain forms of glandular growth allied to Hodgkin's disease which present important differences. A local growth may occur, lymphadenoma in structure, confined to a single group of glands, the other lymphatic structures of the body being free from disease. Similar growths may occur in the alimentary canal, and, rarely, elsewhere. In these cases the morbid tendency appears to be local, not general. Other forms occur (such as a visceral growth with nodules in the spleen) intermediate between these cases and those more general affections to which the term Hodgkin's disease is fairly applicable.

Other cases, again, differ by the opposite characteristic. In them there occurs sudden general glandular enlargement, commonly attended with an excess of white corpuscles in the blood, and so rapid and acute as to lead to death in a few weeks. Such are the cases recorded by Dr. Paterson, and already mentioned (p. 533). They had the aspect of intense glandular irritation, but without tendency to suppuration.

Some forms of scrofulous affection of the glands are also related to lymphadenosis. The characteristic of the scrofulous change in the glands is the low vitality of the tissue elements. In the early stage of enlargement the two conditions are very similar, but the elements of the scrofulous gland quickly die, undergoing fatty degeneration, and leading to general caseation or suppuration. There are cases, already mentioned, which present a mixed change, in which the characters of lymphadenosis and scrofula are blended, and some glands suppurate or

caseate while others, with the spleen, present the changes characteristic of Hodgkin's disease, or in which the glands are enlarged as in Hodgkin's disease, and the spleen presents the cheesy softening nodules of scrofula.

The relation of lymphadenosis to splenic leucocythæmia must depend on the view which is to be taken of the latter disease. According to the general principle adopted in these articles, the existence of leucocythæmia furnishes no reason for separating certain cases of primary glandular enlargement from the rest. In the preceding article it has been held that splenic leucocythæmia depends essentially on the hypertrophy of the extra-lymphatic splenic pulp, and that the blood-state is conditioned by the imperfect development of the cells which are produced in the spleen, and which pass into the blood. We have in the splenic pulp a lymphatic tissue which is of, but not in, the lymphatic sytem, which possesses remarkable relations to the lymphatic system, of which the Malpighian corpuscles are part,[1] but which is so far outside the lymphatic system that it may be the seat of overgrowth without the occurrence of a corresponding overgrowth in any part of the lymphatic system, or even of detached lymphoid growths, without such growths elsewhere,[2] whereas the occurrence of growths in the Malpighian follicles is usually associated with the occurrence of growths elsewhere in the lymphatic system. An hyperplasia of the splenic pulp may, however, be conjoined in any degree with morbid changes, overgrowth, &c., in the lymphatic system, including the Malpighian follicles of the spleen, and hence arise the mixed forms of disease alluded to in the preceding article as "lymphadeno-splenic leucocythæmia."

The distinction between the cases in which the glandular swellings are hard and those in which they are soft was first made by Virchow, on the ground that the difference corresponds with a difference in the state of the blood, an excess of leucocytes being present in the blood in the former, and absent in the latter cases. He proposed to separate the soft cases as "lymphatic leucocythæmia," suggesting, however, that after all the distinction might be unessential. But many cases of the soft form without leucocytal excess in the blood are on record,[1] and although there are unquestionably some clinical differences between the two forms, neither their history nor their pathological anatomy justifies their separation as distinct affections. The two conditions may be conjoined, the superficial glands may be hard, and the deeper glands soft, or the same glands may be at first soft and ultimately hard.

The anæmia commonly accompanies the general glandular enlargement: very rarely being noted first. It appears therefore to be a consequence of the gland disease. The opinion now generally held that the white corpuscles are the source of the red, and are themselves formed partly in the lymphatic structures, glands, and splenic follicles, renders the blood-change in this disease intelligible. The change in these structures must, in the indurated form, arrest the formation of the cells, or their passage to the blood, and cause an anæmia, progressive as the gland disease progresses. The deficiency of red globules in these cases is some evidence that the corpuscles from the lymphatic glands (as well as those which are formed elsewhere) undergo transformation into red discs. If so, it is intelligible that when the new growth is such that the cells can pass into the blood (as in some of the soft forms) they may be so altered in their tendency of development that they may persist in the blood and give rise to an excess, more or less considerable, of white corpuscles. But an excess of leucocytes is not to be ascribed in all cases to the glandular enlargement. In most cases the spleen is also enlarged; in many it presents not merely the isolated growths, but an hyperplasia of the splenic pulp; in some this hyperplasia is the only change. But this is the alteration which is found in splenic leucocythæmia; and to it the excess of white corpuscles is commonly attributed. It is probably also a source of an excess of white corpuscles in many cases of Hodgkin's disease. It is so, almost certainly, in the mixed cases in which the spleen is very large, from hyperplasia of the pulp. and the excess of leucocytes in the blood is very great (1 to 3 or 4). It has been urged by Dr. Wilks that in all the cases excess is to be attributed to the splenic change. But there are cases on record in which a moderate and even considerable excess was associated with a normal spleen (see foot note on p. 546), and it

[1] It was the original idea of Malpighi that the follicles were the origin of the lymphatic vessels of the spleen, and Giesker also maintained that they were more closely allied to the lymphatic system than the splenic pulp. (Untersuchungen über der Milz, 1835, p. 154, quoted by Virchow, Ges. Abh. p. 188.)

[2] Pye-Smith's case, Path. Trans. vol. xxi. 1870, p. 390.

[1] Cases recorded by Moxon, Bonfils, Leudet, Hérard, and others." Hence the term "pseudo-leukæmia" has been restricted to these cases, and the hard form has been distinguished as "lympho-sarcoma," "desmoid carcinoma," &c.

seems reasonable to ascribe the excess in these cases to the passage of the altered gland-cells into the blood.[1] Sœmerring long ago showed that enlarged glands are permeable to quicksilver injected into the lymphatic vessels, and Schmuziger found that the lymph channels in the enlarged glands in leucocythæmia were also permeable.

It may be said generally that the generalization of the new growths is throughout the lymphatic system, and that the tendency to their occurrence is apparently in proportion to the amount of lymphatic tissue normally existing in the part. The chief seat of the tissue is the glands and the splenic follicles, there the chief development of the disease takes place. The collections of lymphatic tissue in the alimentary canal are frequent seats of the secondary overgrowth, and the lymphoid growths in organs arise in interstitial spaces which are now known to be continuous with the lymphatic channels, and occupied by a retiform tissue. But in each of these situations growth may occur alone or out of all proportion to that elsewhere, causing the isolated or preponderant tumors of certain glands, or of the alimentary canal, already mentioned.

DIAGNOSIS.—The chief diseases from which lymphadenosis may be distinguished are—(1) local gland lymphomata, with or without secondary extension; (2) spleno-lymphatic leucocythæmia; (3) scrofulous enlargement of glands; (4) cancer.

A local gland lymphoma, single or spreading only to the glands next in the course of the lymphatics, is separable, as a local disease in its position and extension, from cases in which other growths exist in situations in which they can only arise in consequence of a blood infection or general predisposition. Where such wide generalization has taken place, the cases are inseparable, by any anatomical feature, from the typical forms of lymphadenosis. Even the cases of simple local growth cannot be sharply separated from cases of Hodgkin's disease, since in the latter affection certain glands may precede and greatly preponderate over that of the rest.

Spleno-Lymphatic Leucocythæmia.—From a pure splenic leucocythæmia their distinction scarcely needs statement. The characteristic of the special form is the absence of any initial glandular enlargement. The cases of splenic leucocythæmia with a late affection of the glands are distinguished clinically by the same character. But there are the forms of mixed affection, already many times referred to, in which there is a simultaneous enlargement of glands and spleen, accompanied with a leucocythæmic state, and in which the form of splenic enlargement is simple hypertrophy. According to the view adopted in the present articles, these are cases in which the two forms of disease are conjoined. The distinctions from simple lymphadenosis consists in the early and considerable enlargement of the spleen, and in the large size of the white corpuscles of the blood, and, after death, in the absence of isolated growths in the spleen.

Scrofula.—The anatomical difference of the glandular enlargement in scrofula from that in Hodgkin's disease has been already pointed out as consisting mainly in the tendency of the tissue elements to an early death. Clinically, they are distinguished by the following characters. In scrofula the enlargement is usually limited to one or more groups of glands which have been subjected to a local irritation. The glands affected enlarge rapidly and then remain stationary in size, undergoing softening, or rarely remaining firm. In lymphadenosis the disease may commence with the affection of one or a few glands, but the enlargement persists without diminution. Scrofulous enlargement of glands occurs chiefly in the young, that of lymphadenosis may occur at any age. Hence, although early age does not furnish any distinguishing character, adult age is in favor of lymphadenosis. In scrofula there are the well-known characteristics of skin, lips, &c., the tendency to low inflammation of mucous membranes, and to diseases of the bones and joints, all of which are absent in lymphadenosis. In lymphadenosis there is the long duration and commonly progressive course of the affection, sometimes better and sometimes worse, but continuing (except in the rare acute cases) for one or more years. The connective tissues adjacent to the glands are frequently and early affected in scrofulous enlargement, rarely in lymphadenoma, and then only late in the affection. Lastly, the tendency of the elements of the scrofulous glands to decay shows itself by the tendency to suppuration, which is wholly absent in pure lymphadenoma. Scrofulous glands do not, as a rule, attain the large size which lymphadenotic tumors often reach, but, as Virchow pointed

[1] The remarkable case described by Lücke affords indirect evidence of the possibility of this origin of leucocythæmia. A large axillary lymphadenoma had ulcerated into a vein. Post-mortem, the spleen was normal, and there was no other glandular growths. During life the numbers of the red and white corpuscles in the blood were equal. The cells of the tumor precisely resembled the corpuscles in the blood. (Virchow's Arch. 1866, vol. xxxv. p. 524.)

out,[1] the distinction is not of universal application, since scrofulous gland tumors do occasionally reach a very large size. Now and then mixed forms of disease are met with in which one or two glands in a case of lymphadenosis suppurate, and others undergo caseation. The fact must be borne in mind and an opinion formed from the general character of the gland.

In the cases in which all the glandular structures of the system undergo a scrofulous overgrowth and degeneration, as in the case quoted from Morgagni (p. 529), a diagnosis during life is almost impossible, and can only be made by the occurrence of secondary softening in the glands. It must be remembered that in lymphadenoma the common change in glands is an induration, especially in the local cases in which the diagnosis from scrofula is chiefly needed; and any distinct diminution in the consistence of glands, especially if accompanied by a simultaneous diminution in size, suggests a process of degeneration, and therefore a scrofulous nature. As long as the change is limited to one group of glands, the diagnosis between scrofulous enlargement and commencing lymphadenosis is, it must be confessed, often difficult and sometimes impossible, and it is necessary to wait until the development of other characters decides the question.

Cancer of the lymphatic glands may be confounded with lymphadenoma, but chiefly with the forms which consist in the generalization of a lymphadenoma which begins locally. The microscopical distinction of the two affections is complete. A scirrho-encephaloid, or an encephaloid cancer arising in the glands, has its distinctive structure in cells and stroma. In lymphadenoma, although the stroma may, in rare cases, have some resemblance to that of cancer, there are no cells of epithelial type. The clinical distinction between the two consists in the slow extension of cancer to neighboring glands, and in the localization of the later growths in organs rather than in glands, and the freedom of the spleen. On the other hand, in lymphadenosis glands out of the lymph stream are early involved, and the spleen becomes enlarged with secondary growths.

PROGNOSIS.—In all cases in which the affection is widely spread the prognosis is most grave. When the growths are also considerable in size a fatal termination is practically certain. But the duration of the disease is various, and the progress sometimes is very slow.

Sex affords no guide in prognosis. Nor does age give much information. It seems, however, that cases in children run a little less rapid course than cases in later life, and that age is therefore a somewhat unfavorable element in the prognosis. Previous health is also significant. A preceding cachectic state, from some independent cause, is of grave augury; such cases run a rapid course. Those, on the other hand, in which the disease commences in the course of fair health are much more chronic. Among the most rapid cases are some in which the disease was preceded by a profound depression of general health, the result of imperfect nourishment, or some lowering affection, of hemorrhage, or of parturition, and some general cause, such as a severe exposure to cold, lighted up the affection.

Wunderlich thought that the cases in which the glandular swelling begins at many points run a less rapid course, and are more amenable to treatment than those in which a local enlargement of glands precedes the general affection. But the statement is of doubtful accuracy. Among the examples of each form are some of rapid and some of very slow course, and a comparison of a large number of cases shows that many of those which begin locally are very chronic.

The prognosis is in one respect rather better in the soft than in the hard glandular enlargements, because if, in the case of the former, the disease is influenced by remedial agents, the glands may recover functional power, while the hard glands are usually so much altered in structure that their return to a normal condition is almost impossible. But, on the other hand, if the treatment has no beneficial effect, the course of the softer form is the more rapid of the two. The occurrence of a slight excess of leucocytes in the blood has little influence on prognosis. Temperature is a symptom which, on the whole, indicates a rapid course. This is especially true of the continuous elevation and early pyrexia. The occasional irregular attacks of pyrexia have little prognostic value. Of other individual symptoms perhaps the gravest is the occurrence of œdema, which usually precedes, at no long interval, a fatal termination. The degree of anæmia, and especially its tendency to increase, affords important information, and by the numeration of the blood-corpuscles we are able to estimate its degree and variation in a more definite manner. A considerable, and especially an increasing, excess of leucocytes in the blood also renders the prognosis worse.

TREATMENT. — The local commencement of the glandular disease, suggesting the idea of a primary growth infecting the system, has led to the extirpation of the enlarged glands. In many cases in which the glands first enlarged have been removed, the further progress of the disease has been apparently uninfluenced. In all

[1] Krankhaften Geschwülste, vol. ii. p. 728.

cases in which the affection of the glands was widely spread, even although elsewhere slight in degree, the removal of a group of glands chiefly enlarged, has not hindered the increase in size of the remainder. But in other cases, in which such indication of widely-spread disease was absent, an operation has been followed by a very marked improvement in the patient's condition, by a delay in the occurrence of the disease elsewhere so considerable that it has been reasonably ascribed to the extirpation, and in a few cases the disease has been apparently permanently arrested.

These results are in harmony with the pathological conclusions already suggested. The phenomena of the disease point, on the one hand, to the constitutional nature of the affection, and on the other, to the operation of local causes, determining the early and preponderant affection of certain glands; and they do not exclude the idea of a malign influence exercised by the earliest growth, which, for want of a better term, we call infective. It is evident, therefore, that in proportion as the constitutional condition is conspicuous in a case, the extirpation of the tumors may be expected to be without beneficial influence, and conversely, as the indications of a constitutional affection are inconspicuous, and the co-operation of local causes may be assumed as the most important immediate influence, benefit may be anticipated from the removal of the chief tumor.

Many recorded cases illustrate these conclusions. The removal of glands in the presence of indications of a general affection has been so unsuccessful as to lead many surgeons to abandon the idea of operative interference in any case, especially since a tendency to general glandular disease may exist and be latent at the time of the operation.

On the other hand, some favorable cases have been published, especially by M. Verneuil, of Paris.[1] He removed from the neck of a man a glandular tumor, which extended from the skull to the sternum and threatened suffocation by pressure on the trachea. Seven years afterwards, the man continued perfectly well. In 1866 he excised a mass of glands the size of a child's head, and of two years' duration, from the axilla of a man aged fifty-five. A small gland in the neck increased in size after the operation, and when it reached the size of a turkey's egg was removed, being separated with great difficulty from the carotid artery and jugular vein. During the next few years one or two small glands enlarged and suppurated (arsenic being given internally). Six years after the first operation there were one or two small stationary glands in the groins and neck, but the patient was otherwise perfectly well, when he died of acute double pneumonia.[1] In another case an axillary tumor, with part of the axillary vein, was removed. A year later a gland enlarged in the neck, and afterwards others elsewhere, and the disease ultimately became general, and the patient died, having, however, had six years of comparative freedom.[2]

In the case mentioned above (p. 549) Mr. Heath four years ago excised a mass of glands from the axilla, which had been slowly enlarging for six years. One small gland left in the axilla did not increase in size. Three years passed before there was any other evidence of the disease, and then all the glands on the same side of the neck began to enlarge, and are now slowly increasing.

In these cases the patient's condition was certainly improved, and the course of the disease was probably retarded by the operation.

From a comparison of the experience of Verneuil, Panas, and others, the following conclusions may be drawn regarding indication and contra-indication for excision.

The cases which are most favorable for an operation are those in which the disease is localized in a single region of the body, in which there are no enlargement of the glands elsewhere, no enlargement of the spleen, no pyrexia, and no considerable anæmia. It may be doubted whether the presence of one or two enlarged glands elsewhere, if not increasing rapidly in size, forbids an operation, provided no other contra-indications exist. Enlargement of the spleen certainly lessens much the chance of benefit, but if the organ is small, stationary, and the anæmia is not great, an operation may be undertaken, since cases with merely an enlarged spleen often remain stationary for a long time. The occurrence of pyrexia must be regarded as absolutely contra-indicating an operation, and so also must considerable anæmia. The degree of anæmia cannot always be inferred from the appearance of the patient, and it is desirable that accurate observations should be made in future cases. Probably, when the blood contains less than 60 per cent. of the normal proportion of corpuscles, extirpation should not be adopted. An excess of white corpuscles in the blood has been regarded as precluding any chance of success. It is doubtful whether this is a rule of absolute application. From the facts already considered, it seems probable that a slight excess of

[1] Bull. de la Soc. de Chirurg., 1872, p. 396.

[1] Bergeron, Sur les tumeurs ganglionnaires du cou, Thèse de Paris, p. 116.

[2] Ibid.

white corpuscles, say forty or fifty per field, is often due to a local growth, and it is very rarely that a larger excess is present in any case in which the question of operative interference arises.

In some cases an operation may be justifiable for the relief of symptoms, when there is no prospect of influencing the progress of the disease. The chief conditions in which, for this purpose, extirpation may be necessary are — (1) when death is threatened by the pressure of an accessible mass of glands on some important part; (2) when, by their pressure on nerves, &c., the tumors occasion severe pain or great inconvenience; (3) when a preponderating tumor threatens to soften and ulcerate, and kill the patient much sooner than he would probably die from the general disease. In all cases, and especially in the last case, the risk of the operation must of course be taken into very careful consideration.

A mass of enlarged glands generally has deep connections, often with important structures, and their extirpation frequently is very difficult. But the difficulties are said to be often less than they appear, in consequence of the readiness with which the glands "shell out" without the use of the knife to divide their deeper attachments.

Verneuil, indeed, after having twice ruptured and tied the jugular vein, urges that neither exposure of the arteries nor ligature of large veins materially increases the risk of the operation. It must be remembered that the occurrence of generalization is not always indicated by symptoms, so cases, apparently the most favorable, may turn out badly. Verneuil removed a large tumor from the groin of a patient who was apparently healthy, but died of pyæmia, and in the liver and visceral glands were new growths, which must have existed before the operation.

Other methods of local treatment of the superficial glandular swellings have been employed, and have appeared useful in some cases. Rubbing and shampooing the glands has been followed by distinct diminution in their size, and probably is more useful when the glands are soft than when they are hard. It may act by assisting the passage of their corpuscles into the lymphatic vessels. The alternate application of cold and heat to the glands by douches has been recommended. Cossy reported a case in which, by douches, "massage," and the administration of iron, the glands were reduced in size one-half. The application of ice has also been recommended, but has in no case effected more than a very trifling reduction in the size of the tumors. The same may be said of treatment by compression, carefully carried out by Billroth. Niemeyer, for the same object, employed and recommended repeated blistering, and the same treatment diminished considerably the size of a mediastinal growth in a case reported by Müller. Painting with iodine has also been very frequently employed, but with little benefit.

Galvano-puncture of the glands has been tried by Leyden,[1] Lücke,[2] and Billroth[3] without good result. Von Mosengeil[4] lessened tumors by causing sloughs by its means; but the operation is extremely painful, and often leads to troublesome sores.

Various injections into the substance of the glands have been tried, especially by Lücke, Czerny, and others—iodine, iodide of potassium, nitrate of silver, chloride of gold, quinine, carbolic acid, gastric juice, chromic acid, and arsenic. Most of the injections excited inflammation, abscess, &c., but no true resorption. Injections of arsenic alone have not appeared to do good, but, combined with the internal administration of arsenic, they were thought by Winiwarter[5] to be useful. One drop of Fowler's solution was injected on each occasion. Considerable radiating pain was occasioned, not immediately, but a few hours afterwards. Winiwarter found, on examining glands which were excised a few days after an injection, that in the seat of the injection red corpuscles were effused, thrombosis had occurred in the vessels, and the area affected was sharply limited without adjacent inflammation. Occasionally, however, inflammation, and even suppuration, may occur. The latter is to be avoided, since an abscess is slow to heal and interferes with the treatment. Suppuration occurs in the skin more readily than in the glands, and hence it is important that the exterior of the canula be perfectly clean, and free from any of the liquid to be injected.

General medicated baths have been used. Trousseau thought that baths of corrosive sublimate, administered three times a week, were useful. Various natural baths on the Continent have also appeared to do good in some cases, especially Kreuznach. The sulphur baths of the Pyrenees have also been recommended.

Of internal remedies, iodine, from its supposed influence on scrofulous affections, has been largely used both in the form of tincture of iodine and the iodides of iron and of potassium. They have, however, done little good. Iodide of po-

[1] Salkowski in Virch. Arch. Bd. lii. p. 58.
[2] Kottman, Inaug. Diss.
[3] Billroth, Wien. Med. Wochenschrift, 1871, No. 44.
[4] Von Mosengeil, Arch. für Klin. Chirurgie, Bd. xv. p. 146.
[5] Arch. für Klin. Chirurgie, 1875, vol. xviii. p. 98.

tassium was strongly recommended by Wunderlich on account of the recovery of one, not very conclusive, case. The glandular enlargements (inguinal and cervical) had existed for nine days only before the onset of an attack of diphtheria, during which the iodide was commenced. During the convalescence from the diphtheria the glands lessened in size, and in eighteen days they had disappeared. The same occurrence has been noticed after other febrile diseases in cases of even longer standing. In a case recorded by Mader, the use of iodide of potassium was accompanied by a considerable diminution in the size of the glands, but the patient died soon afterwards, and it is not uncommon for the glands to lessen in size before death.

Cod-liver oil has been given with advantage in some cases, and seems most useful when any indication of a scrofulous diathesis was present. Quinine in a few cases has appeared to do good. In the anomalous case recorded by Bohn (p. 543) it appeared to have a distinct influence in arresting the fever and leading to diminution in the size of the glands. In most other cases, it has been useless, even in large doses.

Arsenic has been given without success by several observers, but cases in which it did good have been recorded. Billroth relates a case of a woman, aged forty, with enlarged glands of ten months' duration, varying from the size of a hen's egg to that of the fist, in the neck, axilla, and groin, and the spleen twice the normal size. A fortnight after arsenic was commenced the glands were noticeably smaller and the diminution continued, so that in two months only one gland remained on each side of the neck the size of a filbert, and the remaining glands were still smaller. In other cases its action was less decided. Its use in increasing doses, up to forty drops daily, has been recommended, especially by Winiwarter. Increased pain in the tumors and general fever (the morning elevation slight or absent, the evening reaching 101°–103°), preceded or accompanied the diminution in the size of the glands, and signs of gastric disturbance, with increased emaciation, occurred even in the cases in which the result was best. These symptoms, apparently the result of the toxic action of the arsenic, are evidently not without danger, for one patient, in whom the glands lessened remarkably, died of marasmus, and another of erysipelas consequent on the excision of a small gland for diagnostic purposes. My own experience of arsenic has not been favorable. In several cases in which I have given it I have been unable to attribute any improvement to its use, although an influence on the glands was evidenced by the occurrence of considerable pain in them. In the recorded cases in which benefit accrued the diminution in the size of the glands was soon observed. In all it is necessary to omit arsenic for a day or two when toxic indications are noted.

Phosphorus has been of late given in this disease. It was first used for lymphadenoma by Verneuil,[1] from whose clinique several cases have been recorded, in which the tumors lessened remarkably in size. In one case I found that a remarkable diminution in the size of the glands accompanied its use, and an excess of leucocytes in the blood was reduced from 1 white to 4 red to 1 white to 100 red; but the patient died, the immediate cause of death being disease of the kidneys, to the occurrence of which the phosphorus had possibly contributed. Fatty degeneration was present in many of the glands, and new growths in the liver. This case, in conjunction with the known effect of phosphorus, suggests that it may do good by causing fatty degeneration of the glandular growths. The case suggests also, however, the difficulty of obtaining this result without producing a similar effect on organs of the body the integrity of which is necessary for life. But it would probably be wrong to assume that this is the only way in which phosphorus acts. In two other cases in which its effect on the glandular disease was inconsiderable, there was a very marked and steady increase in the corpuscular richness of the blood, in each amounting to 20 per cent. A very marked effect in the removal of anæmia has been observed by Dr. Broadbent. In several cases on record phosphorus has been given without any good result.

Mercury was recommended by Oppolzer, who saw temporary improvement from the use of the decoction of Zittmann, an aperient mercurial preparation. Birsch-Hirchfield has tried the internal administration of carbolic acid without success.

Iron for the anæmia is generally useless alone, but has sometimes appeared to do good in conjunction with other remedies. Careful diet, fresh air, and general tonics help the maintenance of the patient's strength, and sometimes appear to influence the disease. Verneuil mentions the case of a student with a very large gland tumor in the region of the vessels of the neck, who went to live by the sea. During the next three years the tumor gradually lessened till it was only two-thirds of the former size.

For the complications of the disease special treatment may be required, and occasionally surgical interference is necessary, especially in cases in which the enlarged glands compress the trachea above a point accessible for operation.

[1] In 1873. Grocler, Thèse de Paris.

ADDISON'S DISEASE.

By Samuel Wilks, M.D., F.R.S.

Definition.—A disease characterized by a gradual loss of strength and general discoloration of the surface of the body in connection with a chronic inflammatory change in the supra-renal organs.

History.—In the year 1854 Dr. Addison published his treatise "on the local and constitutional effects of disease of the supra-renal capsules," but it was as far back as 1849 that he announced to a medical society[1] his discovery of the malady which is now generally known by his name. Since then much controversy has taken place both in this country and on the continent, with regard to the correctness of his statements, and for a long period an incredulity was clearly manifested in the writings of many eminent authorities as to the very existence of such a disease as Addison described. At the present time, however, it may be safely affirmed that the malady known as Morbus Addisonii has a good foundation in our nosology, and that all investigations have tended to corroborate the remarkable accuracy and truthfulness of the descriptions given in his original treatise. The only fact of importance which has been discovered since the publication of his memoir is the uniformity of the changes found in the supra-renal bodies after death, Addison not being himself aware that the disease in the capsules was of a special kind. As regards the symptoms, Addison's description is as full and accurate as any that has been subsequently given; but as to the exact nature of the complaint, and the relation of the events which characterize it, he professed no knowledge, and these have remained up to the present time in the same obscurity. Indeed, if we except the fact of a better acquaintance with the uniform character of the morbid changes in the supra-renal organs, our knowledge of the disease is much as Addison left it.

General Description of the Disease.—Before proceeding to any details of the symptoms, we think we cannot do better than place before the reader the following forcible and succinct account of the complaint contained in the original treatise of the author. He says, "The patient gradually becomes languid, weak, and indisposed either to bodily or mental exertion; appetite impaired or entirely lost; the white of the eyes becomes pearly, the pulse small and feeble, or perhaps soft and compressible; the body wastes without presenting the dry shrivelled skin and extreme emaciation usually attendant on protracted malignant disease; slight pain and uneasiness is from time to time referred to the region of the stomach, and there is occasional actual vomiting, which in one instance was both urgent and distressing, and it is by no means uncommon for the patient to manifest indications of disturbed cerebral circulation. Notwithstanding these unequivocal signs of feeble circulation, anæmia, and general prostration, neither the most diligent inquiry nor the most careful physical examination tends to throw the slightest gleam of light upon the precise nature of the patient's malady; nor do we succeed in fixing upon any special lesion as the cause of this gradual and extraordinary change." "With more or less of these symptoms we discover most remarkable, and, as far as I know, characteristic discoloration taking place in the skin, sufficiently marked indeed as generally to have attracted the attention of the patient himself or the patient's friends. The discoloration pervades the whole surface of the body, but is commonly most strongly manifested on the face, neck, superior extremities, penis, and scrotum, and in the flexures of the axilla and around the navel. It may be said to present a dingy or smoky appearance, or various shades of deep amber or chestnut brown, and in one instance the skin was so universally and so deeply darkened, that but for the features the patient might have been mistaken for a mulatto." "If I see a patient who presents this peculiar discoloration of the skin, and with this a certain train and combination of general symptoms, a pearly eye, a feeble pulse, a disposition to strongly-marked anæmia, and a few other symptoms less constant, I say this is a case in which you will find disorganization of the supra-renal capsules."

It will be seen from this description that there are three characteristic features of the disease, and that all other symptoms are trivial, or arise immediately out of these three. They are the constitu-

[1] London Med. Gazette for 1849, p. 517.

tional symptoms, the local effects on the skin, and the changes found after death in the capsules, or, to be more definite, a marked asthenia, a general pigmentation of the surface of the body, and a chronic inflammatory change in the supra-renal bodies. These are the three elements of the disease, and present such striking and distinguishing features, that if the first two are found to be present the third may be safely predicated. It will be convenient to consider each of these three divisions separately; and first of all to speak of the changes which take place in the capsule itself, for by so doing we have a basis of knowledge respecting the chronic nature and duration of the disease.

ANATOMICAL CHANGES IN THE SUPRA-RENAL ORGANS.—These organs in a well-marked case of Addison's Disease are found wholly destroyed, being converted into a substance which, from its outward appearance, usually passes by the name "scrofulous;" when cut through, the investing membrane is seen to contain a large mass of morbid material closely resembling a firm scrofulous gland, and exhibiting not a trace of the original glandular structure. The evidence of this material being scrofulous rests on no very good foundation, and therefore it might be regarded, provisionally at least, as a result of the ordinary changes which take place in inflammatory lymph. A very similar substance when found in the lung and other organs is usually regarded as one of the transitional stages of an inflammatory product. As regards the very earliest change in the capsules no case has yet been recorded where incipient disease has been found; nor is this likely to be met with, unless the victim of it were cut off by some acute malady. Up to the present time, whenever the organs have been found diseased the whole structure has been affected, and there has been every reason to believe that their destruction has been the cause of the patient's death. Although, therefore, it is unlikely that we shall meet with a case where the very earliest morbid alterations are apparent, yet, as Addison's Disease is one which may be protracted over many years, we have an opportunity of observing the changes in the capsules through several later stages. These stages may be conveniently divided into three. In the *first stage*, or the earliest in which the disease has been met with (but not inadequate to cause a fatal result), the organs have been found much increased in size, reaching to two or three times that of the natural dimensions of the capsules in a state of health. At this period it is rare to find a trace of the original structure remaining, but in its place there exists a firm solid substance which the older pathologists were accustomed to style lardaceous, not, however, intending to signify that peculiar matter known in more recent times as amyloid. It is an albuminoid material of a grayish white color, homogeneous in appearance, firm when cut, and on section having a somewhat translucent character. It is the earliest known change which the capsule undergoes, and at this time nearly all the original structure has been destroyed, or if any be left it is recognized only by small dark spots which are the remnants of the cortical substance. The supra-renal organ has thus been converted into a morbid mass or lump of albuminous material, having very slight resemblance to its original form. Whether this morbid matter be the product of inflammation or not, the fact must be remarked that an inflammatory process has been associated with the disease, for the investing membrane of the supra-renal body has become changed into a thick tough capsule, and this is found firmly adherent either to the summit of the kidney, or, if the disease be on the right side, to the under surface of the liver.

At a later period, or in the *second stage*, this albuminoid material undergoes degenerative changes, commencing in isolated spots, so that it presents on the cut surface a number of yellow dots; these increase in size until the whole of the diseased organ is seen to have scattered through it a number of rounded yellow masses, about the size of peas, and resembling in outward appearance soft yellow tubercle. It is far more common to find the capsule in this condition than in the first stage just described—that is, the diseased organ, when removed from the body and a section made through it, is seen to be composed of two constituent parts—the homogeneous translucent grayish substance already described as the primary formation, and imbedded in it the softer or more friable yellow deposit.

At a still later period, and this for the sake of distinction may be called the *third stage*, the whole of the originally formed material may be changed into this yellow substance, and now it is that it presents the ordinary appearance of a mass of yellow tubercle. During this degenerative process the whole organ shrinks, and becomes reduced to about its original dimensions. After this, still further changes may ensue, as in similar deposits in other parts of the body, and thus a drying-up process may take place, and a cretaceous matter be formed. It is therefore not unusual to find, in the midst of the yellow material before spoken of, some deposits of a chalky substance, and if the shrinking still continues the whole mass of morbid material may become even smaller

than the original organ. In many cases a still further change ensues by a process of softening, and the solid material becomes converted into a creamy or pus-like fluid, so that when the capsule is cut through this may escape just as in opening an abscess. Herein lies the explanation of those recorded cases of supposed Addison's Disease where it is stated that no capsules were discovered, but a little purulent matter occupied their place.

These are the successive changes which the supra-renal organs undergo in Addison's Disease, which may be styled the albuminoid stage or that of enlargement, the stage of cheesy degeneration, and the final stage when this is completed, ending in cretaceous deposit or liquefaction. It is rare to meet with the organ in the primary enlarged condition, and it is not usual to find the final stage of softening, but in the majority of instances the disease will be seen in the intermediate stage, where a number of yellow amorphous masses are found set in a translucent substance. It is this more usual condition which has suggested the idea of tubercle, a term which could not with any propriety be applied to the earlier or later stages of the disease. When examined by the microscope the albuminoid material is seen to consist of irregular-shaped cells, elongated nuclei and fibrillated structure holding them together. The yellow portions display shrivelled nuclei with fat granules and amorphous molecular matter. The original deposit consists of a low organized albuminous material disposed to fibrillate, and which readily undergoes a decay into the yellow amorphous substance.

Symptoms.—As the disease in the capsules is passing through the successive stages just described, so the derangement of the health becomes more and more manifest, until the characteristic features of it are fully developed. It may be that the disease remains almost unrecognized until the period of completion, but generally it is evident that the patient is a sufferer from some hidden malady long before the diagnostic symptoms present themselves. For the sake of lucidity and of formal arrangement, however, we may consider that the symptoms slowly increase in severity as the successive changes in the capsules take place. Thus at the commencement the symptoms have appeared so insidiously that they are scarcely recognized by the medical attendant; who would perceive nothing more than a general derangement of health, with weakness and indisposition to bodily or mental exertion. At this time there would probably be loss of appetite or anorexia. In exceptional cases the gastric disturbance may be present from the very first, and thus actual vomiting. In some cases, especially if carefully looked for, some slight discoloration of the skin might be observed, but as a rule this is not one of the earlier symptoms. At a later period, or after some months as the disease advances, the failure of strength becomes more manifest, especially on attempts at walking or on any slight exertion. The disturbance of the gastro-intestinal canal is usually more marked, and sickness becomes one of the most troublesome symptoms. With this depression there may be giddiness, swimmings, and sometimes pain at the epigastrium or in the loins. The pulse is very feeble, and now the discoloration may have become marked, so that the whole body has assumed a dark hue. In what may be called the final stage corresponding to a complete destruction of the capsules, the discoloration is sometimes universal, and very striking to the most careless observer; the sickness or loathing of food is more marked; the patient may have become so weak from nervous and muscular debility as not to be able to remove from the recumbent posture, the pulse is thready or scarcely to be felt, and with this extreme depression there may be added some nervous symptoms, such as delirium or convulsions.

The Asthenia. — The most universal symptoms, and perhaps the most important, are those dependent on the asthenia, a term implying an utter sense of prostration or powerlessness, and in the present instance without any adequate cause to produce it. It is most important that this should not be forgotten, since an opinion has prevailed amongst many who have had no experience of the complaint, that the constitutional symptoms in Addison's Disease are characterized by anæmia and wasting. This is not the case, as neither of these conditions is present. It is true that the patient has a pearly eye, which is all the more marked from the contrasted color of the darkened skin; but the lips and gums are not bloodless, nor do the muscles after death present that pale color seen in anæmia. The ordinary symptoms of anæmia, such as throbbing headache, palpitation, and breathlessness, are not those which more immediately characterize the presence of Addison's Disease. The symptoms are rather those of asthenia or want of nerve-power, exemplified by the extreme feeling of prostration on the part of the patient, and made known to the medical observer by the remarkably thready and feeble pulse. No symptom is so striking as the fact of the patient sitting in his chair not seeming very ill, perhaps conversing with those around him, and yet having so small a pulse that it can with difficulty be felt; or at a later stage lying in bed talking, or

even, as the writer has seen, singing in a low voice, and yet be absolutely pulseless at the wrist. In such a case the medical man is not so much reminded of the feebleness dependent on poorness or loss of blood as of the prostration which is witnessed in cases of cholera or peritonitis. As the patient is not anæmic, neither is he wasted. It is an error to describe the subjects of Addison's Disease as emaciated. The patient is reduced in bulk and weight, but his limbs are rounded, and after death a good layer of subintegumental fat is found. The body does not present that withered dry appearance so often seen in abdominal cancerous disease. Associated with the asthenic condition, and probably as a mere manifestation of it, some other symptoms may be noted. The most marked of these is the sickness or vomiting. Sickness indeed has been an almost universal symptom, and in some cases of so urgent and persistent a nature that the patient has succumbed to its effects at a very early period of the complaint; and if this has occurred before any signs of discoloration have become manifest, the case may have been regarded as one of cancer of the stomach; if diarrhœa has been associated with the sickness, the case may have been styled one of gastro-enteritis. Such instances, however, are quite exceptional. At the same time there may be more or less pain at the epigastrium, between the shoulders, or in the loins. Other symptoms indicative of a perverted state of the nervous system may be observed; but they are those which might be expected to attend so depressed a vital condition. Thus during the progress of the complaint there may be neuralgic pains in the limbs, and towards the close delirium or convulsions.

The Pigmentation of the Skin.—In a typical case the whole cutaneous surface of the body is discolored, and the patient, if he have before an ordinary white skin, now assumes the appearance of a native of a hotter clime, so that he may be asked if he have any dark blood in his veins. The color at the commencement of the complaint is brown, or olive-green brown, and becomes darker or blacker as the disease advances. The greenish tint or walnut-juice shade (as an artist who has taken many portraits of patients has styled it) gave rise at a very early period in the history of the disease to the expression "bronzed skin," as indicative of this remarkable change. Although the discoloration is more or less uniform over the whole body, some parts are more intensely affected than others; thus those regions which are darker in the black races are most liable to pigmentation in this disease, viz., the genital organs, the axillæ, the areolæ of the mammæ, &c. The discoloration is also observed to be more marked in those parts which are more exposed to the sun, as the face and backs of the hands, especially over the joints, also those parts on which any pressure may have been exerted, as around the body by a waistband, or around the leg by a garter. In all these parts where the color is darker it is gradually shaded off into that of the surrounding skin; in no case does it cease abruptly or is the pigmentation in circumscribed patches. To the inexperienced, such instances of discoloration in patches surrounded by pale skin are often regarded as cases of Addison's Disease; but they are purely local affections and examples of leucoderma. In Addison's Disease, on the other hand, the discoloration is so uniform that in more than one case the patient has been regarded as a mulatto or man of color. A closer investigation, however, would show the distinguishing features between them, for in the Englishman the hair might probably be light, and his eyes of a blue or gray color. In only one or two recorded instances has it been observed that the hair has become darkened. In all cases which the writer has examined the scalp has retained its natural hue, the nail has preserved its whiteness, and the soles of the feet and palms of the hands have remained colorless. In some cases the discoloration does not cease with the skin; but pigment may be discerned on the buccal mucous membrane; so that the gums, inside of the cheeks and of the lips, may be sometimes found to present a few black spots. In one or two cases there has been a black patch on the tongue. It has been stated, but without apparent sufficient foundation, that pigment has been met with on the mucous membrane of the bronchi, intestines, genital organs, and other viscera. It is certainly sometimes seen on the peritoneum, but as this is occasionally found in other cases than in those of Addison's Disease, it cannot be said that there is any connection between them. At present, therefore, it must be affirmed that, with the exception of an occasional pigmentation of the buccal mucous membrane, there is little evidence of discoloration of the internal parts of the body. On examination of the skin by the microscope the pigment is found to occupy the cells of the rete mucosum in the form of dark-brown granules, just as in the dark races of mankind; the section shows the pigment following the undulation of the papillæ where it is more thickly deposited; whilst the true cutis beneath remains healthy.

Order of Symptoms.—Addison asserted that the more advanced the change in the capsules the more discolored will probably be the skin of the patient, and

likewise the contrary, that where the first albuminoid stage has not been passed no alteration in the color of the skin will be expected. After the publication of his memoir, Addison met with a recent case of this kind where no discoloration was present, and since this, some few other similar cases have been observed. These facts would tend to show that the pigmentation of the skin does not occur at a very early period of the complaint, but is one of the later symptoms, and that the constitutional asthenia is really the most important pathological feature, and may be the only symptom present when the patient falls a victim to the disease. It would appear from this that the subjects of Morbus Addisonii are sufferers from the various manifestations of debility long before any apparent change is observed on the skin. Probably this is the case, although it may be true that when the patient is first seen by his medical attendant some discoloration is observable, since his symptoms until that time are not sufficiently severe to compel him to seek advice. It must, however, be admitted, on the other hand, that occasionally the altered color of the skin has been accidentally observed by the friends at a time when the patient had not regarded himself as being out of health. From this fact, and the analogous one of the skin being sometimes only slightly discolored in advanced cases, the above rule can only be considered as a general one and applicable to the majority of instances. The fact, however, must be remembered that in some remarkable and exceptional examples the disease has run a rapid course to its end, and before the development of any pigment in the skin. It is for this reason and that because nervous depression is the only symptom which is invariably present, that one French writer has suggested the name "Asthenie Surrénale" for Addison's Disease, instead of "Melanodermie Asthenique," a term previously proposed.

Duration of the Disease.—In some cases the history of the illness has been as brief as six months; in others it has been prolonged over several years, making an average taken from a large number of cases of about one and a half years for the duration of the complaint. It must be remembered that in those cases which have been termed acute, on account of the short illness and the severe nature of the symptoms, the capsules have been wholly converted into a new material, and therefore it is reasonable to suppose that as soon as the disease is recognized and symptoms appear, that the supra-renal capsules are totally destroyed. It will be thus seen that the above calculation applies only to the duration of the symptoms, as we have no data by which to determine the time necessary for the deterioration of the capsules. It is probable that this is very lengthened, and judging from the cretaceous deposit it is fair to conjecture that the disease is extended over many years.

Mode of Death.—Death is generally slow, and ensues from an aggravation of all the symptoms of asthenia which have so long existed. The patient has become weaker and weaker, the heart's action more feeble, so that for some days before death he may be absolutely pulseless, and life in the gentlest manner ebbs away. Sometimes, however, the patient, having been reduced to the lowest state of vitality, remains in this condition for weeks and months, and then suddenly expires. He may indeed die slowly and imperceptibly like a plant, or, his vitality being all but gone, he may continue some time like a flickering flame, and then in a moment be gone. As before said, there may sometimes be associated with the final catastrophe delirium, slight convulsions, or coma.

Age and Sex.—Addison's Disease is met with at all ages of adult life and in both sexes, but more rarely in children and in very old people. By far the larger number of cases have occurred in men before the middle period of life.

Association with other Diseases.—In the majority of recorded cases of Morbus Addisonii, no other disease than that in the capsules has been found in the body, and thus by a fair inference it has been supposed that the symptoms and the death of the patient have been dependent upon or intimately connected with the destruction of these organs. In some cases there has been observed a vascularity or apparent hypertrophy of the glandular structure of the intestinal canal as in diseases where a long-continued irritation or much gastro-intestinal disturbance has been present. Thus Brunner's glands in the duodenum, and the solitary glands in the ileum and colon, have been found more than usually prominent in Morbus Addisonii. In some cases tubercle has been met with in the lungs, and this fact taken in connection with the peculiar change found in the capsules has confirmed the opinion in the minds of some that the disease is really scrofula, but it must also be stated that the deposit in the lungs has generally been of the same kind as that in the capsules, whose true nature has been the subject of discussion. In the majority of instances, however, the lungs and all the other organs are healthy. Should the disease

be of the nature suspected, we have the very exceptional fact of tubercle existing in a part of the body for many years, sufficient in importance to kill the patient, and yet not found in the lungs. This would almost constitute a reason in itself for not regarding the disease of the capsules as scrofulous. Another complication which has been met with in a few cases is a caries of the spine, and the seat of the disease has been adjacent to that in the capsules. In some of these instances the history of the spinal affection has dated back long anterior to that more immediately associated with the capsules, and therefore if the two diseases have been in any way connected, that of the spine must be regarded as the older. The connection may be looked upon as a mere coincidence, but there seems no pathological objection to the conjecture that the supra-renal organs may have become affected in consequence of the adjacent caries of the bones.

PATHOLOGY.—There is the very strongest evidence in favor of the opinion that the change found in the capsule is peculiar, uniform in character, and primary in its nature. We mean by this that it does not consist of various forms of disease, and is not a mere accidental part of a malady affecting the body generally, but that it is as much a primary and essential disease as a cirrhosis of the liver, or a granular degeneration of the kidney. It is unfortunately true that Addison, not content with placing on record his few genuine examples of the complaint, hazarded a conjecture that cancer or any other destructive agency might develop the same symptoms, but he gave no instance in corroboration of it, and no subsequent writer has published a single case where cancer, tubercle, or indeed any form of benignant or malignant growth has been productive of the genuine symptoms, nor indeed has any case been recorded where degenerative changes other than those previously described have given rise to the complaint. In all the cases where the symptoms have been well marked the change in the capsule has been of one kind and essentially primary. A moment's consideration would convince the pathologist that a complaint having uniform symptoms as pronounced as any disease in the nosology, would have almost of necessity a counterpart rather in those diseases which we style Morbus Brightii, cirrhosis of liver, or phthisis, than in those which admit of such general expressions as kidney disease, liver disease, or lung disease, which include cancer, tubercle, abscess, or indeed any morbid condition to which the organ might be liable. In studying the diseases of these organs we speak of those primary affections just named, and not of any adventitious affections which may attack them from without. So in Addison's Disease all pathological and clinical considerations would make us disclaim the notion that any accidental diseases of the supra-renal organs would produce so uniform a set of symptoms as are always attached to it. All such considerations are opposed to it, as for example its duration, which is very different from the rapid course of these secondary affections; a cancer for instance would endure infinitely too short a time for the production of a complaint which lasts for years. Then again, the sole seat of disease being in the capsules and affecting both simultaneously would be sufficient to show its essential primary nature, since diseases of this kind would necessarily attack both organs simultaneously, and lead to their destruction without evidencing themselves in other parts of the body. Then again, although one would not wish to introduce any *à priori* argument into a question of fact, it might be presumed that a chronic affection of the nature of Addison's Disease would necessarily be dependent (supposing it to be due to a change in the capsule) upon a change analogous to that found in other chronic diseases, that is, one due to inflammation and its results; using the term of course as loosely as is done when cirrhosis is styled a chronic inflammation of the liver, Bright's disease a chronic nephritis, or many forms of phthisis chronic inflammation of the lungs. As regards the latter, the material commonly found in the lungs as a result of inflammation closely resembles very often that met with in the supra-renal organs.

We might mention that in several articles to be found both in French and German works on the subject of Addison's Disease, the authors have collected some hundreds of cases where the supra-renal organs were diseased, also cases where the skin was discolored, and where asthenic symptoms prevailed. On carefully perusing these the position we have taken is clearly proved; that the symptoms which Addison described can be associated only with one form of disease of the capsules, although this is not the conclusion of the authors themselves, who have also mistaken cases of leucoderma and other cutaneous affections for it. Martineau, in his memoir, after collecting a large number of cases, says, "il est évident que la maladie d'Addison ne pourrait être considerée comme entité pathologique." A careful perusal, however, of his own cases might have enabled him to arrive at an exactly opposite conclusion.

Believing, then, that the change in the capsule in Addison's Disease is uniform, the question arises as to its nature, and whether it shou'd be styled scrofulous or

inflammatory. As regards the former term its physical characters alone are not sufficient to identify it, since no specific peculiarities of scrofulous matter have yet been announced. Then, again, unless it be asserted that scrofulous matter always originates in the degeneration of a prior albuminous product, another objection would arise, for such a degenerative process is the one which occurs in the disease of the supra-renal capsules. Again, it may be remembered that the capsule is met with in the last stage of softening or chalky degeneration when none of the ordinary appearances of scrofula can possibly be seen. We should consider also that if we regard scrofula as a constitutional affection we have here the case of two organs being selected for attack and remaining the sole receptable for the deposit for many years without any part of the body being affected. It has, nevertheless, been asserted by some that Addison's Disease is a manifestation of the tuberculous cachexia, and that the change in the capsules is the mere outward evidence of its presence, and therefore the latter cannot be regarded as the cause of the fatal issue any more than the discovery of an enlarged spleen can be looked upon as the cause of death in intermittent fever. If this were true it would constitute a very remarkable fact in the history of scrofula. Under what appellation then shall the disease be known? We think provisionally it might be called inflammatory. An albuminous material, it may be remembered, is formed which subsequently degenerates. Exactly under what circumstances this arises cannot be declared, but as in the present era of medicine we are in the habit of speaking of such productions as results of inflammation we may well adopt the term here. And it would not be denied that such a process had been present when the investing membrane is found thickened and adherent to surrounding parts. On the supposition of the disease arising from a chronic inflammation it would not be unreasonable to conceive it having its origin in a blow on the back, a strain, or a previous caries of the adjacent vertebræ.

Etiology of Symptoms.—The symptoms described by Addison in connection with the disease of the supra-renal capsules were of so remarkable a kind that immediately on the publication of his treatise a fresh interest was at once excited in the minds of physiologists as to the use of these organs. Experiments were first instituted with a view to the corroboration or otherwise of the deduction which was supposed to flow from Addison's clinical observations as to the vital nature of the capsules, for it seemed probable that their removal in a living animal would produce the well-marked symptoms which Addison described. It is remarkable that the first experiments on animals did show (it was said) an exactly similar train of symptoms, and that when these organs were removed there followed an increasing weakness, impeded circulation, fall of temperature, failure of appetite, convulsions, and death, whence it was considered that these organs were indispensable to life. There was found also an increase of pigment in the blood, and it was supposed therefore that the capsules were vascular glands and carried on the metamorphosis of a substance destined for the formation of pigment. Other experiments however soon followed, and the truth of all these statements was denied. Indeed, all further physiological research has tended to throw no additional light on the function of the supra-renal capsules. It had been too readily assumed by many authors that Addison in his treatise had suggested the vital nature of the supra-renal organs, whereas his facts tend distinctly to prove the opposite—that persons may live for years when the capsules are wholly destroyed. At least, this is the only conclusion we can arrive at when we consider the length of time necessary for the production of the cretaceous deposit which is sometimes found within them, being guided moreover by the experience of the changes witnessed in the mesenteric and other glands. Subsequent experimenters, especially interested in the subject of pigmentation of the skin, renewed their examination of the blood in connection with the coloring matters of the urine, the bile, and that of melanosis, and they then compared these with the dark pigment found in the healthy capsules. There was however little more discovered than the fact published by Vulpian that the blood of the supra-renal veins gave a special reaction to various tests, and that a peculiar substance which was formed in the substance of the organ was poured into the blood and gave a bluish tint with perchloride of iron. The blood too has been carefully examined microscopically and been said to present certain peculiarities in the shape of the corpuscles, in their relative proportion, in the deficiency of fibrin, in excess of coloring matter, &c., but all these statements have been denied by other experimenters. Various theories in explanation of the pigmentation have been advanced, but they cannot be sustained, since most of them would apply to a general discoloration of all the tissues of the body, and could not account for a pigmentation which affects the skin only, exactly as is seen in the dark races of mankind. From a consideration of all that has been written on this subject we are in a position to state that the immediate cause of the discoloration must at present be regarded as

unknown, and also that the connection between the discoloration and the change in the capsule is equally obscure, whether indeed it be due immediately to destruction of that organ, or whether it be only one feature of cachexia, as sometimes witnessed in a modified form in tuberculosis or in old age, but which in the disease under consideration is slowly brought about by the destruction of the capsules.

As regards the asthenia, one of the three great phenomena which characterize Addison's Disease, it is remarkable that most of the experimentalists alluded to were agreed that a very decided and sometimes fatal depression succeeded an injury or crushing of the supra-renal bodies, just as when the neighboring sympathetic ganglia were similarly treated, and thus Addison's own views on the cause of the asthenia gained considerable support. Addison had at once seen that these organs could not be considered vital in the ordinary acceptation of the term, since they might be functionally absent during the lifetime of the patient, and thus he was induced to consider whether their contiguity to the great ganglionic centres and the implication of the nerves of the latter might not account for the remarkable depression which is the most universal symptom of the disease, and these were his words:—"We know that these organs are situated in the immediate vicinity, and in contact with the solar plexus, and the semilunar ganglia, and receive from them a large supply of nerves, and who could tell what influence the contact of these diseased organs might have on these great nerve centres, and what share that secondary effect might have on the general health, and in the production of the symptoms presented?" Since Addison thus spoke, Brown-Séquard and Mattei have shown that by crushing the organ similar results followed as when the sympathetic was experimented upon. The latter writer says: "in a rabbit I violently compressed both capsules at the same moment. The animal gave a sharp cry and fell into a state of prostration; respiration almost ceased, and in a few minutes it was dead." Now it may be stated as a matter of fact that, besides the implication of nerve branches in the semilunar ganglia, the capsules have sometimes been so enlarged as actually to involve the ganglia themselves in their morbid mass. Such explanation for the asthenia also draws Addison's Disease into closer relationship with such an affection as peritonitis and cholera, where from the extreme depression we are forced to consider that the abdominal sympathetic nerves are subjected to a pernicious influence. The objection to this interpretation of the asthenia is that it makes the symptoms quite independent of the destroyed function of the organ and suggests a mere accidental implication of the nerves. Also it must be stated that no morbid change in the semilunar ganglia has yet been discovered, although they have been carefully examined by the writer and other observers. The remarkable combination of asthenia and pigmentation in Addison's Disease has suggested to some physiologists the double function of the organs, and thus whilst some have been regarding them as nothing else than nervous ganglia, and others as little more than lymphatic glands, Kölliker had advanced an opinion that the central portion might be classed with the vascular glands, and engaged in the function of secretion, whilst owing to the great nervous richness of the medullary substance, the latter might be an apparatus forming part of the nervous system. Brown-Séquard has established after Ecker, Frey, and Kölliker, that the peculiar cells of the gland resemble nerve cells. According to Pappenheim and Remak the nerves of the supra-renal capsules are composed only of embryonic fibres. On the contrary Kölliker maintains that he has seen only true nerve tubes, and no trace of the fibres of Remak. Brown-Séquard has shown that in some animals there exist fibres of Remak. He has seldom seen fibres of double outline; very fine nerve fibres (sympathetic fibres of Bidder and Volkmann) abound in them. He believes them to be the most sensitive of the abdominal viscera. The nerves of the capsules actually dissected proceed for the most part from the semilunar ganglia and solar plexus; but some of their branches arise from the pneumogastric and phrenic nerves.

Diagnosis.—Bearing in mind that the constitutional symptoms are often those only of asthenia, and the local those of discoloration of the skin, it may readily be conceived how difficult may be the diagnosis at an early period of the complaint, when these symptoms are but slight. If it be true, also, as it probably is, that a nervous exhaustion may exist long before a discoloration is apparent, then a true appreciation of the symptoms at the onset of the disease may indeed be impossible. Thus it is that in the acute form of the complaint there has rarely existed a suspicion of its existence. Still it cannot be too strongly insisted on that such asthenia is an equally important symptom as the discoloration, and it is from overlooking this fact, and regarding merely the more striking external features of change of color, that so many errors have been made. And, as regards the discoloration itself, its peculiarities have so often been misunderstood that, when present in the true form, it has been overlooked, and when exhibiting altogether false characters it

has been regarded as a picture of Addison's Disease. Scarcely a single genuine case has come before the writer where in the course of its history the liver had not been selected as the source of the evil, whilst on the other hand a large number of cases have been referred to him as examples of the disease where the surface was covered with patches of leucoderma or pityriasis. Now as regards the first, the error should never have been made, seeing that in Addison's Disease a true pigmentation of the skin exists, whilst in jaundice the discoloration is due to circulation of bile through the system, and necessarily stains not only the skin yellow, but also the conjunctiva, the urine, and other secretions. In Addison's Disease it may be remembered that the eye is of a pearly white, and also, as has been stated, that the pigmentation is universal on the surface, which likens the body to that of the dark colored races; it is an obvious error therefore to mistake leucoderma for such a condition, since the patches in this affection are remarkably defined, and the parts adjacent to the spots of pigmentation are morbidly white; and as regards pityriasis it may be remembered that the skin is rough, which is not the case in Addison's Disease, where the epidermis is not affected. Those who have once witnessed an example of the true form of the disease will have no difficulty in recognizing it again, and to such persons there is no disease whose diagnosis is more easy. The patient is, as a rule, young, generally a male, who has had increasing loss of power, without any very evident reason to place its cause in those organs whose diseases are most familiar to us, and with this depression is a disposition to sickness, and subsequently a general discoloration of the skin making itself apparent. If the patient is seen for the first time when the complaint is fully developed, the diagnosis can be made with as much certainty as that of any other disease in the nosology.

Prognosis.—From what has been already stated, the prognosis can only be of one kind, and that necessarily unfavorable. For, if it be true, as all consideration of the disease would make it appear, that as soon as the complaint is diagnosed, the capsules are irretrievably destroyed, and that sooner or later their destruction leads to the patient's death, there can be only one expectation as to the result. The only hope can lie in the possibility of an error of diagnosis. On the other hand, the fact of these organs remaining functionless for years, and yet the life of the patient being retained so long, would make us hesitate as to the exact time in which the inevitable result must ensue.

Treatment.—As before said, since the organs are destroyed when the diagnosis is made, the treatment can only be directed to the sustainment of the patient's powers by rest, good living, and tonic medicines. Galvanism has been tried with the hope of imparting by this agent a fresh vigor to the system, but no manifest improvement has resulted.

Patients, however, who make a stay of some weeks in the hospital leave again in an improved state of health; therefore there is reason to believe that the medicines which are given them tend to counteract the symptoms. The sickness which is so often an urgent symptom may be relieved by bismuth, hydrocyanic acid, and such like remedies, whilst the tone of the stomach may be improved by mineral acids and bitters, especially nux vomica. As tonics—iron, quinine, and cod-liver oil are useful; and one patient who left the hospital in better condition ascribed it to the remedy, which was phosphorus. The same woman, however, on a second occasion improved in health after a short residence in hospital when she took chloride of calcium, administered to her on account of its absorbent properties. In other cases arsenic has been useful by counteracting the cachectic condition, which it is known to do in other forms of disease, in some inscrutable, but in no less decisive manner.

EXOPHTHALMIC GOITRE.

By Hermann Beigel, M.D.

Synonyms.—Graves' Disease; Basedow's Disease; Struma Exophthalmica; Goître Exophthalmique; Tachycardia Strumosa (Lebert); Cardio-thyroid Exophthalmos (Walshe).

Under one of the above titles a group of symptoms has been described, of which the most constant are Exophthalmos, Goitre, and Palpitations. Some authors[1] are of opinion that Flajani[2] had some notion of the connection existing between these symptoms, but after a careful examination of the numerous cases of exophthalmos which this author published, I have not been able to find anything confirming this opinion. It is true he mentions several times the occurrence of palpitation in cases of exophthalmos, but he is by no means conscious that the concurrence of these phenomena—he does not mention goitre at all—constitutes a special disease. In another place he relates three cases of goitre occurring with palpitation in men, and in all these he made a cure by mere local treatment of the enlarged thyroid gland; in these cases, however, he does not mention the existence of exophthalmos, so that we may safely say that Flajani was not aware of the disease at present known by the name of Exophthalmic Goitre.

It seems that Percy[3] was the first to pay attention to the enlargement of the eyeball in connection with the other two symptoms, but he also did not recognize the real relation between them.

Graves[4] was the first who distinctly described three cases of palpitations and goitre, and, when speaking of the latter symptom, he says that the enlargement of the thyroid "seems to be essentially different from goitre in not attaining a size at all equal to that observed in the latter disease. Indeed, the enlargement deserves rather the name of hypertrophy, and is at once distinguishable from bronchocele by its becoming stationary just at the period of its development, when the growth of the latter begins to be accelerated. In fact, although the tumor is very observable when the attention is directed to it, yet it never amounts to actual deformity." We shall see when we come to the symptoms of the disease, that Dr. Graves' observations were perfectly correct, and still hold good. Besides these three cases he describes one[1] in which all three symptoms, viz., exophthalmos, goitre, and palpitations were very marked. The latter developed first and produced a pulse "never under 120, and often much higher;" after about a year exophthalmos was noticed, and "in a few months the action of the heart continued with increasing violence, a tumor of a horseshoe shape appeared in the front of the throat, and exactly in the situation of the thyroid gland."

At about the same time Marsh[2] of Dublin and Pauli[3] treated of this subject; but full light was thrown on it by Basedow[4] in 1840, who described a new kind of disease under the name of "Exophthalmic Cachexia" (Glotzaugencachexia), as the most prominent symptoms of which he names palpitation of the heart, goitre, and exophthalmos. Since that time many cases have been published by different authors, of whom we need merely name Praël,[5] Gräfe,[6] Charcot,[7] Aran,[8] Trousseau,[9] Claude Bernard,[10] and Handfield Jones.[11]

Symptoms. — The first symptom observed in these cases is the palpitation of the heart; at first slight, but rapidly increasing to a very great degree, and oc-

[1] Dr. Paul, Berlin. Klinisch. Wochenschrift, 1867, p. 227.

[2] Giusseppi Flajani, Collezione d'osservazioni e reflessioni di Chirurgie, vol. iii. p. 270. Roma, 1802.

[3] Caleb Hilliard Percy, M.D., A collection from the unpublished medical writings of. London, 1825.

[4] Robert J. Graves, M.D., A System of Clinical Medicine. Dublin, 1843, p. 674.

[1] Robert J. Graves, M.D., A System of Clinical Medicine, p. 674, Dublin, 1843.

[2] Dublin Journal of Medical Science, vol. xx.

[3] Heidelberger Medicinische Annalen, 1837.

[4] Casper's Wochenschrift, 1840.

[5] Archiv für Ophthalmologie, Bd. iii. p. 199.

[6] Ibid. p. 278.

[7] Gazette Méd. de Paris, 1856, No. 38.

[8] Ibid. 1862.

[9] Ibid. 1862, No. 29.

[10] Gazette Hebdom. 1862, No. 37; and Gaz. Méd. de Paris, 1862, No. 37.

[11] Medical Times and Gazette, 1860, vol. ii. p. 541.

curring in paroxysms produced by slight exertions or nervous excitement. In the case published by Graves,[1] "the beating of the heart could be heard during the paroxysm at some distance from the bed, a phenomenon I had never before witnessed, and which strongly excited my attention and curiosity."

The number of beats is seldom less than 100, and may become so violent as to shake the whole thorax. Nevertheless, the physical examination of the chest can only detect organic alterations or irregularities of the rhythm when the disease has existed for a long time. In more advanced stages, however, dilatation of the heart takes place, and gives rise to all those changes in the peripheral circulation which usually accompany enlargement of one or both ventricles. It is a remarkable fact that even in cases in which the heart has become enlarged, a high degree of insufficiency of the valves is rarely met with, and yet systolic bruits and noises are common, and may be heard not only at the usual seats of such sounds, but also in the auricles and large vessels in the neck.

The irregularity in the heart's action is sometimes very marked, as in a case brought by Gräfe before the Berlin Medical Society, in which the disease was very intense, and this symptom strongly marked. The intervals between the single contractions in another case were so unequal, and the force of some contractions so slight, that no beat of the radial pulse corresponded to them, so that the beats of the heart exceeded those of the pulse by six or eight in the minute. Friedrich[2] has observed that in the more advanced stages, changes take place in the peripheral circulation similar to those which occur in the heart itself: so that not only the arteries of the extremities exhibit a full vibrating pulse, but that even in the smaller arteries, as for instance the metatarsal artery or the palmar arch, a throb may be felt.

The total number of beats may be even as many as 112, 120, or even 160 (Trousseau) in the minute; in three cases which I have recently observed, the pulse was in two of them never less than 120, and in the other, at a very early stage of the disease, not less than 100.

The second symptom is the enlargement of the thyroid gland. In some cases this may precede the palpitation, but the exophthalmos has never been observed as the first symptom. The enlargement is rather a swelling or fulness of the thyroid region than that kind of tumor which we observe in cases of true goitre, but this rule has exceptions, and occasionally very large tumors may be observed. Generally one lobe of the gland is more affected than the other. A most peculiar appearance is sometimes produced by the trembling of the thyroid mass, combined with, or caused by, very intense throbbing of the carotid arteries; this phenomenon may be perceived by the eye as well as by the hand. Compression of the arteries does not materially diminish the size of the swelling. The surface is usually marked by large and tortuous veins, especially if the disease be of long standing.

Shortly after the commencement of the goitre, and sometimes almost simultaneously with it, the eyeballs appear to become increased in size, and in many cases in a comparatively short time they protrude completely from the orbit, as if, indeed, they had almost fallen from their sockets. When the disease has reached so high a degree the eyelids are not capable of being closed, and sloughing, suppuration, or other changes in the course may occur. Tatham[1] observed a case of a girl of eighteen, who was very pale and of a strumous aspect; the eyes were so prominent that when the eyelids were closed as far as possible a portion of the cornea was still left uncovered; the conjunctiva was seen in a state of strumous chemosis, "there was a deep and extensive ulcer involving almost all the part of the cornea which corresponds to the upper segment of the iris, and the inner part of the surface was sloughing:" the sclerotic vessels could be seen in some parts, and were injected: there was much circumorbital pain."

In some cases the left eye has seemed more affected than the right one; the eyelids do not close even in sleep, and portions of the eyeball are thus constantly exposed to the irritations of the atmospheric air and particles of dust. The expression assumed by the patient's face is a peculiarly unpleasant and painful one.

In the less severe cases the patients usually consider that they are suffering merely from an affection of the eyes; and the symptoms exhibited by them consist, according to Gräfe, in a dryness and irritability of the whole conjunctiva, which is particularly noticed when the patient attempts to read. This is due solely to deficient falling of the upper eyelid, which is incapable of following the downward movement of the eyeball. As a later consequence of this condition, dilatation of the conjunctival veins occurs, and sometimes the formation of crusts—a process which Gräfe considers to be of a neuroparalytic nature, in which the tro-

[1] Loc. cit. p. 674.

[2] Virchow's Pathologie und Thérapie, 2d edition, 1867; Bd. v. 2te. abth. p. 313.

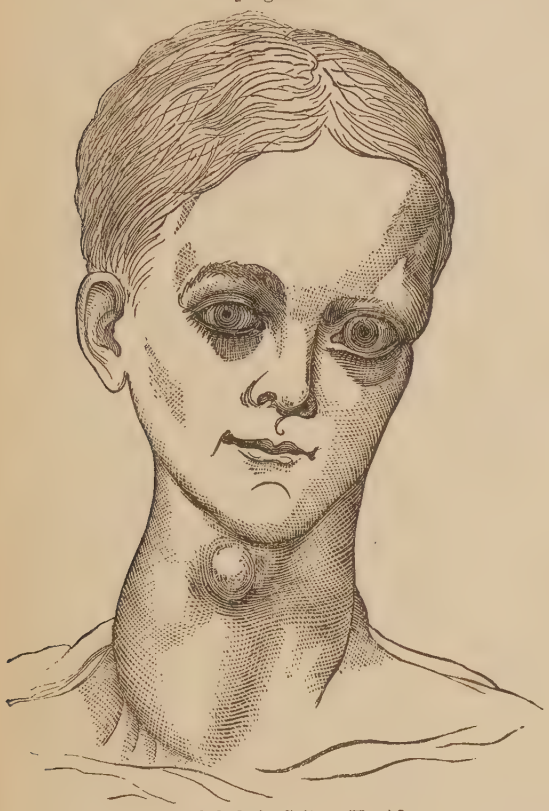
[1] Medical Times and Gazette, 1864, vol. i. p. 89.

phic rather than the sensitive fibres of the trigeminal nerve are affected.

This imperfect falling of the upper eyelid when the patient is lowering the plane of vision, Gräfe considers, in the progressive stages of the disease under consideration, as pathognomonic, and as an additional constant symptom of the affection. He attempts to explain this phenomenon by supposing a convulsive action of the "Musculus Palpebralis Superior," which was discovered by H. Müller.[1] It consists of involuntary muscular fibres, and receives its innervation from motor fibres in the cervical part of the sympathetic. It lies under the anterior part of the levator palpebræ superioris, and is connected behind with that muscle; in front it extends as far as the upper margin of the tarsal cartilage. Its function is to assist the levator in raising the eyelid. Müller has also described a similar muscle in the lower eyelid, which is under the influence of the sympathetic.

With regard to impairment of vision, authors are divided in opinion; but the majority seem to be of opinion that there may be none. When it does occur, it seems to be due to the changes produced by the ophthalmia, and not to any primary changes in the refracting media. No abnormal appearances can be detected by the ophthalmoscope except dilatation and engorgement of the vessels. In two of the three cases which I have myself examined the arterial pulse could be seen very distinctly in the retinal vessels. In the third case, staphyloma posticum existed in a very marked degree, and the patient was myopic; this affection had, however, existed many years before any symptoms of exophthalmos had commenced.

[Fig. 82.



Exophthalmic Goitre. (Yeo.)]

The general symptoms occurring in this disease are almost entirely related as effects to the three principal phenomena above described. The most frequent are fainting feelings dependent upon the palpitation of the heart, and a burning sensation in the face and all over the body, dependent upon the excited state of the peripheral circulation.

In consequence of the abnormal conditions of arterial tension, which have been described above, these patients suffer from noises in the head and ears, paroxysms of suffocative dyspnœa, very distressing thirst, and violent diarrhœa; sometimes even hæmoptysis may occur. The brain is likewise affected in cases of progressive development of the disease; thus Brück[1] describes the case of a young girl of 18 who exhibited occasional paroxysms of vertigo and mania; and Geigel's[2] patient, at the climax of the disease, was attacked by "Monomanie de grandeur."

These are, however, extreme instances, and in many cases the symptoms are so slight, and remain for a long time so quiescent, that the patient only learns from his friends that his eyes are peculiarly large, and that his throat is increasing in size, without being himself aware of any other change. I had a young girl under my care at the Farringdon Dispensary, who was 18 years of age, and had always enjoyed good health. During the previous six months she had suffered frequently from palpitation of the heart and

[1] Verhandlungen der Physik. Medicin-Gesellschaft zu Würzburg, Bd. ix. 1859, p. 244; and Bd. x. 1860.

[1] Casper's Wochenschrift, 1848, pp. 275, 441.

[2] Wurzburg Med. Zeitschrift, Bd. vii. p. 70.

want of breath when moving quickly. A few weeks later she "fancied" that her neck was increasing; and again after a few weeks, her friends told her that her eyes were increasing in size; noises in the head were now felt occasionally, and the patient suffered from fainting feelings. She came under my care on the 26th of November, 1867, and I made the following notes of her condition:—She is strongly built and well nourished, but of a deadly paleness; the eyelids can be shut, although the eyeballs are remarkably prominent, of large size and glaring appearance. The left lobe of the thyroid gland is somewhat larger than the right; but the front part of the neck is decidedly fuller than natural. Artificial light cannot be borne. On auscultation and percussion, besides frequent action of the heart, nothing abnormal can be discovered. Pulse 117. All other functions of the body are natural. The patient had been employed in a warehouse as bookkeeper, but was obliged to give up her situation in consequence of the disease. She was discharged on April 13, 1868, perfectly cured, and has since resumed her former occupation.

The treatment consisted in the employment of a mixture of digitalis and iron. In less fortunate cases the patient soon emaciates, the functions become disturbed, and in women irregularity of the catamenia is usually observed; general dropsy may subsequently occur, terminating in death.

Etiology.—Although we are aware that there are certain districts in which goitre is endemic, yet it is not known that the disease now under consideration is prevalent there. It has been generally observed in countries and in places where true goitre is comparatively rare, and in persons who are not subject to enlargement of the thyroid gland. The disease generally attacks individuals between the ages of 20 and 30. Stokes has, however, observed it in a woman of 60; Trousseau in a boy of 14, and in a woman of 66; Rosenberg in a girl of 7; and Deval in a girl of 2½ years, after scarlet fever.

Women are, it appears, more prone to the affection than men. Of twenty-seven cases collected by Rosenberg and Henoch, as many as twenty-three occurred in women; of Taylor's twenty-five cases, twenty were women: of the twenty-nine cases noted by Praël, only one occurred in a man. Of the eight cases published by Schnitzler, there were but two men. According to Gräfe, the relation of the number of males to females is as one to six; but the affection is stated by the same author to be more dangerous in men than women, both as regards the eye and the life of the individual.

Most of the patients are in an anæmic state, a condition which existed in all the three cases observed by myself; and generally, in the female patients, hemorrhage goes hand in hand with the disease, or at all events irregularities of menstruation may be observed.

The development of the disease is more or less rapid, and often varies, without any assignable cause except general debility and other general phenomena. There are, however, a large number of cases on record which have been developed suddenly after mental and nervous excitement, exertion, or shock. As the effect of emotion, it has been seen occurring during a single night (Taylor and Trousseau); and also after a violent cough and vomiting (Adams); after the cold bath (Percy and Schnitzler); and after a blow on the head (Begbie and Gräfe). One case has been related by Gräfe, in which rapid development took place after forced coition.[1] The patient was a young man 22 years of age, who succeeded in satisfying his desires after a violent resistance of upwards of half an hour. Covered with sweat and prostrate with fatigue, he recovered his strength by taking several glasses of madeira; but on the following morning he felt much exhausted, and noticed a change in his appearance; after another day, exophthalmos was very marked, and, rapidly increasing, soon assumed a most terrible aspect. The first case of those published by Thomas Laycock[2] is very interesting, in so far as it has been rapidly developed after the patient had experienced an intense fright. And Trousseau relates the case of a lady who, after receiving the unexpected news of her father's sudden death, was attacked in a few hours by violent palpitation of the heart, considerable swelling of the thyroid gland, and protrusion of both eyes.

It is evident from the foregoing cases that nervous affections are particularly liable to give rise to exophthalmic goitre; but whether they can do so in otherwise healthy persons is rather doubtful; and it is more probable that the effect takes place in such individuals as are either of a highly excitable temperament, or reduced in their general health by loss of blood, long-continued diarrhœa, fever, insufficient nourishment, bad digestion, excessive mental work, or hysteria, &c. Mental emotions may produce the disease by the very intensity of their character. Thus Friedreich saw it occurring in a highly-gifted lady who was mourning for the sudden death of her son.

From the cases at present published we

[1] Berlin. Klinisch. Wochenschrift, 1867, p. 230.

[2] Med. Times and Gazette, 1864, vol. ii. p. 320.

cannot form any opinion as to the effect produced by hereditary influence which gives rise to this affection; and with regard to the influence of climate we also know nothing. It must, however, be borne in mind that the whole number of cases at present fully reported is comparatively small.

Pathological Anatomy.—As we have just mentioned, the fully recorded cases are not numerous, and still more rarely have the post-mortem appearances been described. I agree, however, with the opinion expressed by Virchow[1]—that it is not only from the anatomical examination of these cases that we have to expect materials for forming an opinion on the nature of this disease, since the phenomena which constitute the first beginning of the disease are of more importance than the conditions observed in the later stages.

It has been shown above, that it is only when the symptoms of the disease have already existed for a considerable time that alterations of the heart occur, which are discoverable by physical examination. The same holds good with respect to the post-mortem appearances of that organ. In the first stage no alteration has been found; but at a later period it has been found dilated, the mitral valve incompetent, the walls of the ventricle generally thin, though in rare cases they may be thicker than normal. Marsh has reported a case in which a general dilatation of all parts of the heart existed; and other authors have described enlargement of one or both ventricles.

Other post-mortem conditions—such as hyperæmia of the spleen (Begbie and Banks), atheroma of the arteries, &c.—must be considered either as secondary results or as accidental occurrences. [Dilatation of the arteries, however, may be considered as one of the changes characteristic of the disease.—H.]

The thyroid gland has been found enlarged by all authors. Virchow describes it in one case in which he made the examination as moderately enlarged, simply hyperplastic, without development of cysts, nodules, or gelatinous formations. The lobules of the gland were more prominent, the interstitial tissue abundant, and the veins enlarged, the arteries remaining unaffected.

Markham describes the glands as large and firm; and Basedow found in one case the enormously enlarged gland filled with hydatids and the veins throughout varicose. In one of Praël's cases the tumor weighed as much as a pound, and reached into the thoracic cavity; the right lobe was cartilaginously degenerated, and closely embraced the trachea.

The cause of the exophthalmos has not been shown by the post-mortem examination; and several theories have been devised to account for this condition. Basedow and Heusinger considered it to be a simple hyperplasia of the connective and fatty tissue situated in the orbital cavity; others, however, as Praël, have been unable to discover any such alteration. It has indeed been noticed by some authors that the eyeballs may return into their sockets after death, or may at last be replaced by very gentle pressure. Some have considered with Taylor, that this symptom was dependent upon hydrophthalmos, but this opinion has likewise been abandoned. Recklingshausen has seen the muscles of the bulb in a state of fatty degeneration; and Archibald Keith noticed that the veins of the orbit were filled with blood, and that some extravasation had taken place into the orbit. Neither of these appearances, however, which seem in some measure to explain the protrusion of the eyeball, has been shown to be constant in the disease under consideration, and still less to exist at an early stage of the affection, when the exophthalmos is already marked.

Of special interest is the condition of the cervical part of the sympathetic nerve, described by different authors. Some have found marked alteration in its structure; others have described the part in question as perfectly normal. Keith[1] describes the sympathetic nerves "on both sides, but especially on the left, as large; the middle and lower cervical ganglia of the left side much enlarged and very firm and hard; the middle cervical ganglion thick in length, varying in width from one-eighth to a quarter of an inch; the lower ganglion seven-eighths of an inch long, and nearly uniformly a quarter of an inch wide. The connecting cords were correspondingly enlarged. Of the branches, those proceeding from the middle cervical to the inferior thyroid artery, and those from the lower cervical to the vertebral artery, were much more enlarged than the remainder, which varied but little from the normal size. Under the microscope, the ganglia seemed loaded with granular matter, observing to a great extent the appearance of nerve-tubes and nerve-cells, and resembling more than anything else the aspect of a lymphatic gland in the early stage of tubercular deposit. . . . . On the right side, the middle and lower cervical ganglia, and especially the latter, were enlarged, firm, and hard, presenting appearances similar

[1] Krankhaften Geschwülste, Bd. iii. p. 73.

[1] Med. Times and Gazette, 1865, vol. ii. p. 521.

to those of the left side, but not to the same extent. The cellular tissue surrounding the ganglia of both sides was thickened and hardened."

Trousseau and Peter likewise found the cervical ganglia of the sympathetic materially altered in respect to the external appearances as well as of the microscopical; but Recklinghausen, on the other hand, found the trunk of that nerve, as well as the ganglia, rather smaller than natural as if in a state of atrophy, but histologically not altered at all.

In the case of Dr. Geigel, both sympathetic trunks were apparently thickened and enveloped in a fatty sheath of connective tissue; but the microscope could detect no alteration in the tissue of the nerves and ganglia, except an intense brown pigment present in the latter.

It is, therefore, necessary to bear in mind that alterations of the sympathetic nerves and their ganglia have been repeatedly observed, but that some authors have failed to detect any such alterations; and it must not be forgotten that physiology teaches us that changes may take place in nerves in such a manner as not to be discoverable by the microscope, the existence of such changes being rendered manifest by altered function in those parts supplied by the respective nerves.

NATURAL HISTORY. — Some few authors (Niemeyer, Duchek) have doubted the existence of Exophthalmic Goitre as a distinct disease, considering the combination of the three principal symptoms as an accidental concurrence—an opinion, however, which is neither borne out by physiological observation, nor by the cases recorded in medical literature, and which is of too little weight to be seriously discussed.

Others (Basedow, Beau) have looked upon the disease as simply a cachectic condition; whilst others again (Henoch) tried to give a mechanical explanation of the phenomena, based on the increased activity of the heart, whereby a larger quantity of blood is pressed into the thyroid gland, and thus produces exophthalmos by venous stagnation and congestion. This theory is by no means borne out by observation, because in many cases the affection of the heart is not the first symptom; and in others, all three phenomena occur at the same time. Large numbers of cases of diseases of the heart, observed in different hospitals every year, are not connected with either goitre or exophthalmos; while, on the other hand, in districts where goitre is endemic, the other two symptoms—viz., palpitation and exophthalmos—do not occur; and thus the mechanical theory must be considered to be untenable.

The only theory which is capable of accounting for all the phenomena observed in these cases, is that which considers the disease to be dependent upon nervous influence; and the more recent writers (Aran, Trousseau, Friedreich, and particularly Geigel) have endeavored to show that it is the sympathetic which is at fault. Trousseau's explanation presupposes irritation of the nerve: Aran traces the symptoms to irritation of the heart and vessels through the cervical part of the sympathetic; whilst Friedreich's opinion is, on the contrary, that there exists a paralysis of those vaso-motor nerves which exist in the sympathetic trunks. Dr. Geigel divides the symptoms, and attributes, on the one hand, the alteration of the vessels to paralysis of the vaso-motor nerves within the sympathetic, and on the other, the changes which take place in the eyeball, to the effect of increased irritation of the oculo-papillary motor twigs derived from the same source. Eulenberg[1] and Landois draw the conclusion that the sympathetic must be affected from the frequency of suppuration of the cornea, the severity of which does not correspond to the other symptoms. Gräfe[2] has observed this occurrence in ten men and four women, and in one case the whole cornea was completely destroyed.

In order to gain an insight into the question before us, we must examine the facts arrived at by several renowned experimentalists when irritating or dividing the cervical part of the sympathetic nerve. According to the unanimous opinion of Claude Bernard, Brown-Séquard, Schiff, and others, the following phenomena may be observed in the eye after division of the sympathetic in the neck. The eyeball retracts into the orbit; the membrana-nictitans is drawn forwards; the upper eyelid falls, and the lower is somewhat raised. If, however, the peripheral stump be galvanized, the phenomena are reversed; the eyeball protrudes considerably; the upper eyelid is slowly raised, and the membrana-nictitans retracts. When the trunk of the sympathetic is galvanized without being divided, the arteries become narrower, even to such a high degree as to be perfectly occluded.

The results of these experiments, though by no means sufficient to explain all the symptoms exhibited in Exophthalmic Goitre, clearly point to nervous action as the real source of the phenomena.

The chief difficulty which meets us in comparing the symptoms of Exophthalmic Goitre with the results obtained by divid-

[1] Wien. Med. Wochenschrift, 1867, p. 1474.

[2] Berlin. Klin. Wochenschrift, 1861, No. 31.

ing the cord of the sympathetic is, as Dr. Geigel justly remarks, that the ocular phenomena of the disease are exactly the reverse of those following the operation, and that galvanism is required in addition to produce exophthalmos. This result seems, in this instance at least, to be caused, as has been shown by Mosler and Landois,[1] by contraction of the musculus orbitalis discovered by H. Müller. These experimentalists have noticed the muscle to contract at each opening and closing of the current, thus producing a momentary protrusion of the eyeball in the dogs and rabbits operated upon. It was at one time believed that the orbital muscles could, by an irregular action, give rise to an exophthalmos; but it is clear that neither the recti nor the obliqui can have any such action; and therefore the musculus orbitalis, and its connection with the sympathetic, has been of the greatest importance in enabling us to explain the influence of the nerve upon the eyeball.

The contents of the orbit exercise a more or less constant pressure upon the walls of the cavity, due in part to the active and passive movements of the bulb, and partly to the distensile force in the bloodvessels. To resist this pressure, there exists in most mammalia a membrane, which separates the orbit from the temporal fossa; and this membrane (membrana orbitalis) contains numerous unstriated muscular fibres. In man the orbit is limited by bony walls, not only towards the temporal fossa, but on all sides; the membrana orbitalis is, therefore, reduced to a small quantity of fibrous tissue, which partially fills up the sphenomaxillary fissure: this has been shown by Müller to contain involuntary muscular fibres, and serves as an antagonist to the other muscles of the eyeball. The discoverer is of opinion that the orbital muscle in man would, under ordinary circumstances, be incapable of protruding the eyeball; but the experiments of Mosler and Landois, just alluded to, show that it is capable of doing so in dogs and rabbits under the artificial stimulus of galvanism; and it is, therefore, possible that pathological changes may give rise to a similar result.

The symptoms referable to the heart and thyroid gland offer less difficulties to an explanation found on the influence of the sympathetic, in so much as their connection with the cervical ganglia are numerous and obvious.

It is the middle and lower ganglia to which we have to look for the morbid changes which influence the three parts principally affected in this disease; but we must wait for further facts which experimental physiology may bring to light before we can explain the nature of these changes. The cases in which post-mortem examinations have been performed, and in which no alteration of these parts was discoverable, do not militate against this view, as we have already alluded to the well-known fact that changes in the nerves may take place which are only to be recognized by the impairment of function, and not by change of structure.

[Dr. Cheadle,[1] of St. George's Hospital, in a careful study of cases of this disease, refers especially to exaggerated vascular pulsation as one of its cardinal symptoms. He gives a plate, representing the extensive dilatation of the arteries of the liver found in a case after death.

A case which I studied in 1879 (patient of Dr. Macomber, of Germantown, Pa.), impressed me strongly with the prominence of *atonic relaxation and dilatation of the whole cardio-vascular system* in the pathology of Exophthalmic Goitre. The patient was a woman, about thirty years of age. While at rest, the sounds of the heart could be heard, and its impulse felt, much beyond their usual limits. After walking up a pair of stairs, the impulse (without great force) became much farther extended; and the heart-sounds became audible, anteriorly and posteriorly, all over the chest. The carotids and jugular veins in the neck also pulsated with great violence on both sides, especially after exercise or mental excitement. These symptoms gradually diminished under iron and digitalis, with careful hygienic management.—H.]

PROGNOSIS.—Exophthalmic Goitre must always be looked upon as a grave disease, and as we are at present entirely ignorant of the real origin of the affection, our prognosis must necessarily be somewhat uncertain. As a rule, however, the cause is a chronic one; and a large number of cases run their course for a considerable period without giving rise to any more serious symptoms than an occasional attack of faintness and of inability for active exertion. Even in the more advanced stages, symptomatic treatment can afford benefit, so that a patient who has previously been unable to do any work can undertake some lighter duties, without suffering serious inconvenience.

The most distressing, and unhappily very frequent complication, is the affection of the cornea, which results from its exposure to the atmospheric air. The advanced stages of the disease seem always to lead to a fatal result; but the statistics are unsatisfactory, in consequence of the small number of cases observed.

[1] Centralblatt für die Medicin, Wissenschaft, 1868, No. 33.

[1] St. George's Hospital Reports, 1877–8.]

TREATMENT.—We have remarked that this disease occurs particularly in such people as are of weak constitution, or have suffered from loss of blood, or from an exhausted nervous system. It is, therefore, necessary to improve the general health by regulating their diet, giving them easily digested food, change of air or climate, and a course of iron, bark, and digitalis, either separately or combined.

In one case, Trousseau has seen an improvement following hydropathic treatment. Handfield Jones and Russell recommend strychnia. Friedreich has seen benefit obtained in serious cases by the continuous administration of large doses of quinine, 12 to 15 gr. in the twenty-four hours; and Duméril, Demarqué, and others, confirm this observation, and consider the drug to act directly upon the sympathetic. It is remarkable that, though many authors speak favorably of the use of iron, yet Bruch and Levy have seen patients get worse under the use of chalybeate spas.

The three cases observed by myself were treated almost exclusively by iron and digitalis. The one related above entirely recovered; the others have been doing well so far that the exophthalmos and goitre have disappeared, and the palpitations and fainting fits, which existed in one patient particularly to a very distressing degree, have been reduced both in frequency and severity, so that the patient, who was formerly compelled to keep her bed, after a few weeks was able to do her house-work with comparative ease and comfort. At the time of her consulting me she was 38 years of age, unmarried, and had had palpitations since she was 7 years old, when she had the measles. These palpitations had increased in intensity during the last six years, and had been combined with want of breath when she exerted herself. The eyeballs had become prominent, and vision somewhat impaired. During the last twelve months she had noticed an enlargement in the thyroid gland, the right lobe of which was as large as a hen's egg when the patient first came under my care (November 9th, 1867). After some months it required careful examination in order to discover the still existing enlargement of that lobe. The third patient was 22 years of age, married, the mother of two children, and very anæmic. She had suffered from palpitation of the heart for four years before counselling me in 1867, which had increased on exertion, and had been particularly troublesome when she ascended stairs. The protrusion of the eyeballs was noticed by the patient and her friends about four months previously; but the enlargement of the neck was so universal and inconsiderable, that the patient was not at all aware of it. She had suffered for two months before coming into the hospital from fainting fits occurring daily. She was under treatment during four months, when the symptoms had almost entirely subsided.

Aran recommends the application of ice to the cardiac region in cases in which the palpitation is very severe. If the goitre should not diminish under general treatment, compression or iodine may be applied locally.

With regard to the exophthalmos, the patient must be recommended to wash his eyes frequently with tepid milk, to prevent the ocular conjunctiva from becoming irritated. Gräfe recommends pressure, applied directly to the bulb, in case of the eyelids still being able to close perfectly; but at a later stage he recommends the operation of tarsoraphy, or detachment of the upper eyelid by an incision along its upper attachment. Compresses dipped in milk, or astringent or caustic solutions, may relieve the affection of the cornea if it should become troublesome.

[Dr. Cheadle[1] urges the importance of continued rest in the treatment of Exophthalmic Goitre; especially in view of its promoting the tranquillization of the cardio-vascular system, whose relaxation and disturbance is so prominent a feature of the disease. Electricity (the continued current) has been recommended, in the treatment of this affection, by Von Dusch, Eulenburg,[2] and other authors.[3]—H.]

[1 Loc. cit.]
[2 Ziemssen's Cyclopædia, vol. xiv.]
[3 Rockwell, in N. Y. Med. Record, Oct. 4, 1879, p. 317.]

[BRONCHOCELE.

By Henry Hartshorne, M.D.

Synonyms.—Goitre; Derbyshire Neck; Thyrocele; Trachelocele; Bochium; Gongrona; Grosse-gorge; Gros-cou.

Objection has been made to the application of the term Bronchocele (from βρόγχος and κήλη) to this affection, because the bronchial tube is not involved in it. But the word βρόγχος (βρόγχια being used more especially for the lower windpipe) meant, with the Greek writers, the *throat*, not the bronchial tube merely, as that term is used by us; and the word βρόγχοκήλη, Bronchocele, was employed by them to indicate a tumor of the throat. Goitre, the Swiss name for the disease, is supposed to be derived from the Latin *guttur*, the throat.

Symptomatology.—Very many cases of this affection are local only, consisting in a painless and mostly gradual enlargement of the thyroid gland. Seldom is it congenital, although cases are reported (*e. g.*, by Godelle, of Soissons, France, and in Derbyshire, mentioned by Sir T. Watson) of children of goitrous parents being born with Goitre. Mostly it does not commence before the eighth year;[1] often not till after puberty. A few instances of *acute* Goitre are narrated. Collin has described one, occurring in 1860–61 in a garrison at Briançon in the Hautes Alpes. Amongst a thousand men in that garrison, fifty-three cases of Goitre were under treatment within fifteen months. In one of these men, the thyroid gland began to enlarge eight days after his arrival at Briançon; most of them, however, were not affected until after several months' residence. Michaud states[2] that Goitre has been several times epidemic in the French army, while the men were making forced marches with insufficient food-supplies in a mountainous country.

When the tumor increases but slowly, does not attain a great bulk, and is quite external to the windpipe, it may be simply a deformity and inconvenience, without other injurious effects. Its size is sometimes very great. Alibert is quoted as mentioning the case of a woman in whom it descended as far as the middle of the thigh. In less rare instances it expands upwards as high as the level of the ears, or downwards so as to lie upon the breast.

Much smaller tumors may give trouble on account of their situation. Sometimes, resting upon the middle of the trachea, sufficient pressure is made to cause dyspnœa, especially upon exertion. Obstruction of the circulation of blood in the vessels of the neck may cause headache, dizziness, fulness of the head, *tinnitus aurium*, &c. Pressure on the nerves (as the recurrent laryngeal), as well as on the trachea, may induce hoarseness or other modification of the voice. Swallowing may be interfered with by the pressure extending as far as the œsophagus. Pulsation of the swollen gland occurs in a few instances, which, so far, approximate to the characters of exophthalmic goitre; but even these cases of simple hypertrophic Bronchocele may always be diagnosticated from that affection.

The right lobe of the thyroid gland is more often enlarged than the left. More women are affected than men. In England especially is this the case. Dr. Andrew Crawford relates that, in ten years, forty-eight women and but one man were admitted into the Hampshire County Hospital with Goitre. At the Chichester Infirmary, as mentioned by Watson, in nine years there were sixty-eight women so affected, and two boys. In specially goitrous localities, as Switzerland, many more males have Bronchocele.

Copland[1] and Tanner[2] assert the existence, in women, of a connection between Bronchocele and irregularities of the menstrual function. Tanner mentions his having observed that the thyroid gland is largest at the menstrual period, especially when the flow is scanty.[3] Others say that

[1 Although this is stated by several authors, some accounts are opposed to it. Thus, according to statistics collected by a Sardinian Commission, in Piedmont, amongst goitrous cretins the Goitre has been observed to appear before the age of two years in more than 2000 out of about 4000 instances; from two to three years, in 199; from five to twelve years, in 449; twelve to twenty years, 157, &c. See Boudin, Traité de Géographie Médicale, &c., tome ii. p. 415.]

[2 Gazette Médicale, Jan. 10 and Feb. 7, 1874.]

[1 Dictionary of Medicine, article Bronchocele.]

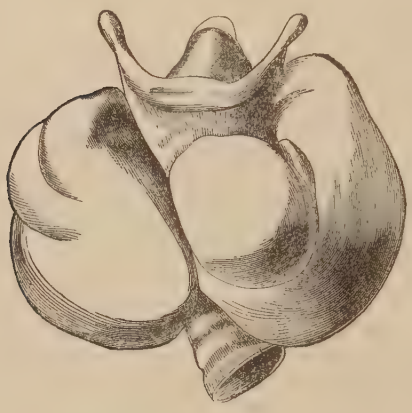
[2 Practice of Medicine, p. 120.]

[3 See report of a case of "Acute menstrual Goitre," by E. H. Bennett, M.D., F.R.C.S.I.,

the increase of enlargement is particularly rapid during the time of pregnancy.

The worst results endangered by Goitre attend its location at the lowest portion of the throat, particularly when the growth occurs in part behind the trachea. This is called suffocating Goitre. Watson[1] mentions a fatal case of this kind, and Bryant[2] another. One occurred in the New York Hospital in December, 1879.[3] Not unfrequently, the situation of these most serious goitrous tumors, being less conspicuous

Fig. 83.



Goitre.

Fig. 84.

Goitre.

than that of some others, causes them to be unobserved until near, or possibly after, the fatal result. Duplay[1] applies the term *retro-sternal* Goitre to cases (called by some *goître plongeant*) in which a small tumor falls or is drawn into the anterior mediastinum, so as to press between the sternum and the trachea. Compression of the recurrent nerves, or even of the pneumogastric, may have part in the production of the symptoms resulting from this state of things.

Morbid Anatomy.—Several degrees or varieties of morbid change are found to occur in Bronchocele. These may be designated as follows: 1. Simple glandular hypertrophy. 2. Soft Goitre. 3. Fibrous Goitre. 4. Aneurismal Goitre. 5. Calcified Goitre.

In the first of these forms, a mere enlargement or overgrowth takes place in the normal elements of the thyroid gland, without change in their nature or proportion to each other. The characteristic vesicles exist in unusual number and size, but their walls are not altered in structure, and both the epithelium lining them and their semi-fluid contents continue normal. This is the usual condition in recent Bronchocele of small or moderate dimensions. It may be uniform throughout the gland, or may affect one or the other (especially the right) lobe alone.

Soft Goitre is characterized by the distension of a number of the gland-vesicles, with increase and greater fluidity of their contents. Thus an almost cystic structure is produced. Sometimes it is not easy, even in examination after death, to perceive the existence of septa between the different vesicles. With the microscope, however, they are seen.[4] A large increase in size is not uncommon with this variety of Goitre.

Fibrous Bronchocele is distinguished by increase of inter-vesicular connective tissue of the gland. Such a Goitre is hard, moderate (usually) in size, and troublesome only or chiefly when its situation favors close pressure upon the trachea. This affection also may be either general or located only upon one side of the gland.

Aneurismal Goitre exhibits dilatation of the arteries, capillaries, and veins of the gland, or of a portion of it; causing a pulsation in the tumor, more or less distinct. Such a Bronchocele is removed

in the Medical Gazette (New York), March 6, 1880, p. 158. Petit is cited as having described a Bronchocele which disappeared upon the establishment of the menstrual function.]

[1 Gazette des Hôpitaux, May 6 and 8, 1879. See also a case recorded by Krishaber (Gazette Médicale de Paris, No. 41, 1878), in which an abscess of the thyroid burst into the trachea.]

[1 Practice of Medicine, 2d American edition, vol. i. p. 798.]

[2 Surgery, Amer. edition, p. 151.]

[3 The Medical Gazette, Jan. 3d, 1880, p. 16.]

[4 Cornil and Ranvier; Manual of Pathol. Histology, Amer. edition, p. 597.]

from "exophthalmic goitre" (see article on that subject) by the absence of prominence of the eyeballs, and of the general cardio-vascular disturbance belonging to that affection.

When the condition of vesicular enlargement, before noticed as soft Goitre, accompanies the aneurismal dilatation of the vessels of the thyroid, hemorrhage into the interior of the vesicles is not infrequent. This may increase the distension of the tumor; and thus one form of cystic Bronchocele may result. Puncturing such a swelling is not free from danger. Bryant[1] states that in one case which he tapped, a profuse bleeding occurred, arrested only by closing the wound.

Cystic Goitre differs from the above-mentioned soft vesicular form only in the greater degree of expansion of some of the gland-vesicles. The contents of the cyst or cysts may vary from a thick colloid material to thin serum, or a sero-sanguineous liquid. Sometimes these cysts burst spontaneously, or may be ruptured by a blow or a fall. A well-known London physician, having a large Goitre, was "garroted" while walking in the street.[2] Being left senseless from the choking process, he found upon recovery that he had been relieved of his Goitre as well as of his watch and spectacles.

Calcified Bronchocele occurs only in old people, or at least after the enlargement of the thyroid has continued for a considerable period. It results from the advanced degeneration of the abnormally modified tissue of the gland; and may be either partial, lobular, or general. Since such a degeneration is not unusual in various organs, there would seem to be nothing specifically important in its occurrence in the thyroid gland. The appearance, in certain instances, of "solid aggregations of calcareous particles,"[3] may possibly be somewhat more significant in regard to the causation of the disease. Inflammation and suppuration of goitrous tumors is, in the absence of some special disturbing or exciting cause, quite uncommon. Cancer, also, is a rare sequence of Bronchocele.

Cretinism.—This affection needs to be mentioned along with Goitre, on account of its almost constant local and personal association with it. There are many goitrous persons who are not cretins; but there are very few cretins who do not also have Bronchocele. When both parents in a family are goitrous for two successive generations, the children of the third generation are very apt to be cretins.

Cretinism is not met with at all in America. It is thus described by authors who are familiar with it: "The stature of the cretin is diminutive; his head is of great size, but flattened at the top, and spread out laterally; while the countenance is vacant and void of intelligence. The nose is flat, the lips are thick, and the tongue is large. The skin is dark-colored, coarse, and rough. The abdomen is sunken and pendulous; the legs are short and curved."[1] Mentally, the cretin is more or less idiotic. Some are merely stupid; others display the extreme of imbecility. In the worst cases, they appear incapable of intelligence or affection; stolid biped brutes.

While there is thus in cretinism a general stunting of the whole organism, it appears, according to Virchow, that inspection of the cranium shows a special pathogeny of the idiotic phase of the affection. He has found that there is, in the heads of cretins, an abnormal formation and premature osseous union of the bones at the base of the skull, the occiput, sphenoid, and ethmoid; along with which there also occurs an excessive bony deposition in the cranium generally. Such conditions will readily account for the arrested development and consequent functional incapacity of the brain. Yet degrees of cretinism undoubtedly exist, such as are hardly to be accounted for by so decided an organic malformation of the skull; especially when, as has been known to happen, suitable hygienic treatment, during childhood, has resulted in partial or total restoration of the mental faculties.

ETIOLOGY.—Goitre is, unquestionably, in much the greater number of cases, an endemic affection. In any locality examples of it may be met with, but they are few. In Philadelphia, for example, and its neighborhood, it is rare. I do not remember seeing, in this city, more than twenty or thirty goitrous persons in as many years. But in mountainous regions, all over the globe, it is common; and it is not quite exclusively confined to these. Switzerland has always been its famous seat, at least since the time of Juvenal; who mentions the "tumidum guttur in Alpibus" in one of his satires. Elsewhere in Europe, it is met with among the Pyrenees, Hartz, and Carpathian mountains; in several departments of France; and in England, especially in Derbyshire, but also in Yorkshire, Nottingham, Hants and Sussex. Sir T. Watson mentions its

[1] Surgery, Amer. edition, p. 151.]

[2] Watson; Lectures on Practice of Medicine, Amer. edition, vol. i. p. 812.]

[3] Ceely; quoted by Aitken, Practice, Amer. edition, vol. i. p. 789.]

[1] Aitken, op. citat., p. 793. See, also, Bucknill and Tuke, Manual of Psychological Medicine.]

occurrence in Norfolk and Cambridgeshire; both *flat* countries. It appears not to prevail in the Highlands of Scotland, nor among the Scandinavian mountains. In Asia, it is common in Oude, in the district near Nepaul and Gorruckpore; in Nepaul itself, and in other parts of the Himalayan region; in Chinese Tartary and among the Caucasian and Ural mountains. The islands of Sumatra and Ceylon have it among their endemic diseases.

In Africa, it has been seen by travellers near the Atlas and the Kong mountains. In North America, some instances of it are known among the mountains of the Appalachian range; in Vermont and New Hampshire, New York, Pennsylvania, and Virginia. In these localities, however, it is not very frequent. Franklin and Richardson, in their explorations, met with a number of goitrous persons at Edmonton, in British America (latitude 53° 45′ N.), near the headwaters of the Saskatchewan or Nelson River, which rises in the Rocky Mountains. In South America, Humboldt and others have met with it among the Andes in Peru and Chili. D'Orbigny remarked that the native American Indian is much less subject to Goitre than the European and the Creole.[1]

With such localization, the question of the causation of Bronchocele narrows itself down, very much, to that of the physical and climatic peculiarities of certain definite regions, such as has been above mentioned. One theory, entertained by many, has been, that it depends upon a constitutional depravation (most extreme in cretins) produced by exclusion of light, stagnation of air, and dampness, in narrow and deep Alpine valleys; such effects being intensified by the unsanitary conditions connected with poverty and ignorance, as well as by frequent intermarriages in restricted populations. Such an etiology has a plausible appearance; and, whatever may be the superior potency of other more special causes, it seems probable that such agencies have an important promotive or contributive action. Against its universal sufficiency, we have the facts already mentioned, showing that Goitre is met with in some flat countries; as in certain parts of India, and especially in Norfolk and Cambridgeshire, England. Moreover, there are several mountain regions, with valleys extremely like those abounding in goitrous and cretinous subjects, yet without any examples of either disease. Tardieu[2] states that portions of the same valley may differ strikingly in this respect; the valley of the Iser River, for instance, being affected with endemic Goitre only upon its left, and not at all upon its right bank. Again, comparing the otherwise similar valleys of the Canton of Berne, one region of fifty leagues of extent contains twice as many goitrous persons as are found in the districts of Englestighen, Frutigen, and the Bernese Oberland.

Some of the facts above mentioned (especially the occurrence of Goitre in Sumatra and Ceylon) exclude altogether the conjecture entertained by a few, that the cause of the affection may be the use of snow-water as a drink. But the influence of drinking-water has, nevertheless, both with the ignorant and with scientific observers, been commonly believed to be of the greatest importance in explaining the endemic occurrence of Goitre.

Three different views are advocated in regard to this: one, that the waters of limestone regions, as such, especially produce the disease; another, that this is true only of those waters which percolate through magnesian limestone; a third, that some other not yet ascertained peculiarity exists in the waters of the goitre-producing localities. Of those peculiarities, St. Leger has asserted the existence of iron pyrites; often, also, with copper pyrites, galena, and baryta. Chatin dwells upon the evidence he has collated,[1] making it appear that a deficiency of iodine is the characteristic of the waters of all such localities.

This inquiry is of a somewhat intricate nature, and belongs rather to sanitary science than to practical medicine. Referring the reader, therefore, to the works already cited (especially those of Boudin and Tardieu) for its discussion, it seems necessary to conclude, that while the hypothesis which ascribes the endemic prevalence of Bronchocele and Cretinism to the habitual use of waters containing an excess of magnesian salts has in its favor the greatest number of facts bearing upon the question, it does not account for them all, and must be regarded, as yet, as not proven.[2] The investigation is well worthy

[1 Voyage pittoresque dans les deux Amériques, p. 455.]

[2 Dictionnaire d'Hygiene Publique, &c., tome ii. p. 355.]

[1 Tardieu, op. citat., p. 359.]

[2 McClelland and Greenhow in India, Coindet in Switzerland, and Grange in France, have especially urged the cogency of the evidence in favor of the *magnesian limestone* theory. In America, Dr. Daniel Drake, of Ohio, in his great work "On the Principal Diseases of the Interior Valley of North America," uses the following language (vol. i. p. 663): "The best kind of hard water is that of springs which issue from the fissures and seams of limestone rocks, or is drawn from wells sunk in them. Such is the water drunk by the people of the most populous parts of the valley of the Ohio River and its tributaries. Their ample development and general good health demonstrate that it is a

of the attention of those who have opportunities for its pursuit. One of the curious and interesting facts is, that, in India and some other places, dogs, cats, goats, and sheep are occasionally affected with Goitre.

TREATMENT.—Both for simple Goitre and for Cretinism, but particularly for the former in young subjects, the most hopeful of all measures is removal from the region in which the disease has been incurred, and in which it is known to be endemic. Dr. Guggenbühl first proved this in Switzerland, by taking a number of cretin children from their native valleys to an elevated locality on the Abendberg, near Interlachen, among the Bernese Alps, and subjecting them to conditions favorable to health. One-third of those thus treated (with the aid of some appropriate medication) were entirely restored to health of body and mind; and most of the rest were much improved.[1]

In the medical treatment of Bronchocele, iodine has been the most favored remedy, since its introduction by Straub of Hofwyl and Coindet of Geneva. While not infallible, especially while the patient resides in a goitrous locality, it will undoubtedly do much good in a majority of cases. Perhaps the designation of *specific* for Goitre may yet be applied to it, notwithstanding some failures. Amongst American authorities, Bartholow[2] says: "Goitre is curable by the internal and external application of iodine, when it consists of simple hypertrophy of the gland-elements." Stillé[3] remarks, "It is probable that all cases of true Goitre in persons under middle age are curable by iodine." My own impression from experience is, that cases originating sporadically, *i. e.*, in regions where the disorder is not endemic, while they are slow in growth, and rarely attain to a very great size, are more apt to resist the special action of iodine than those of an endemic nature: at least when the latter can be treated in an entirely healthy locality.

Internally, iodine may be best given in Lugol's solution, which contains also iodide of potassium. Ten drops of this solution may be given twice daily, for a long time; suspending it if headache, marked dryness of the throat, nausea, or diarrhœa occur. If the dose be increased, it should be done gradually and with careful notice of its effects.

External application of iodine is also recommended. The iodine ointment may be used, or an iodine liniment, diluted with glycerin. Biniodide of mercury has been largely employed in India, by Mouat,[1] Holmes,[2] Whishan, Greenhow, and others. At Fyzabad, the manner of its use has been as follows: three drachms of the red iodide are rubbed in a mortar with nine pounds of suet. This unguent is rubbed into the skin over the tumor with an ivory or wooden spatula about sunrise, and the patient is made to sit with his throat exposed to the sun for several hours. A little more ointment is then rubbed in, and the treatment is completed. Bad cases may require a second and perhaps a third application of it. Mouat reports the use of this medication in many thousands of cases, sometimes five or six hundred in a day; and with satisfactory success. For cases such as are seen in the United States, a more simple and less inconvenient use of the same remedy will answer a good purpose, viz., the inunction, nightly, for a week or more, of the ointment of the red oxide of mercury. From what I have seen of the effects of cerate of carbonate of lead upon some scrofulous enlargements, I should incline to expect that it might have a beneficial action in Goitre; but I have never tried it or known of its trial.

The internal use of cod-liver oil is indicated in all cases of Bronchocele occurring in patients whose nutrition is defective; although it has not been proved to exercise so much influence over Bronchocele as it does over scrofulous affections. The same class of cases will be apt to respond well to the tonic and alterative action of iodide of iron.

More heroic local treatment than that mentioned above has often been practised for Bronchocele. A measure sometimes successful is the passage of one or more iron wires through the tumor, to act as a seton. Care is required in soft, aneurismal, or cystic goitres, lest a vessel be penetrated of sufficient size to cause serious hemorrhage.

Another method is, to apply ligatures to the thyroid arteries, so as to *starve* the hypertrophied gland. Blizard, Coates, and several others have performed this operation, with occasional success; but it is not free from danger, and the collateral circulation mostly prevents a good result. Surgeons have now generally abandoned it.

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salubrious beverage. Nevertheless, there is much dyspepsia within the specified region, and calculous affections appear to prevail more than elsewhere. On the other hand, goitre occurs much less frequently than in sandstone, slate, and coal districts."]

[1 The value of this philanthropic experiment and its success is enhanced by the fact, that from it sprang, by legitimate descent, the "Asylums" and "Training Schools" for Imbecile Children, now doing such good service in England and in America.]

[2 Materia Medica and Therapeutics, 1878, p. 181.]

[3 National Dispensatory, 1879, p. 704.]

[1 Indian Annals, April, 1857.]

[2 Lancet, October 10, 1863, p. 438.]

Störk, of Vienna (1874) has injected a drachm or two of alcohol into soft goitrous tumors. Lücke,[1] of Berne, asserts success with injection into hard goitres of strong tincture of iodine. Morell Mackenzie[2] treats cystic Bronchocele with injections of perchloride of iron. He taps the cyst, and then injects one or two fluidrachms of a solution of the perchloride (two drachms to the fluidounce); this is left in the tumor for three days, the canula being plugged, and then the fluid is allowed to escape. The canula is still left, under a poultice, until suppuration is established.

Excision of goitrous tumors has been resorted to, with various degrees of success. Desault first succeeded with it; so did Hedenus, of Dresden, in six cases; Gooch and Dupuytren met only with failures.[3] Dr. Warren Greene, of Maine,[4] has recorded two successful cases; and others have been reported by Poland,[5] Holmes,[6] P. Heron Watson,[7] and Billroth.[1] The last-named surgeon is said to have exterminated seven goitres, under antiseptic precautions, in a single year. Duplay, however, remarks[2] judiciously upon the serious dangers attending all measures of surgical interference in the thyroid region. Bryant[3] cites with approval the following remarks from Dr. W. Warren Greene's paper, above mentioned:—

"It is, and always will be, exceedingly rare that any such interference is warrantable, *never* for relief of deformity or discomfort merely; only to save life, and if it is, beyond all question, determined in any given case that such an operation gives the only chance for snatching a fellow-being from an untimely grave, be it remembered that accurate anatomical knowledge, and a perfect self-control under the most trying ordeals through which a surgeon can pass, are indispensable to its best performance."]

[1 Lancet, Jan. 2, 1869.]

[2 Lancet, May, 1872; and Clin. Society Transactions, vol. vii. p. 115.]

[3 Copland, Dictionary of Medicine, article, Bronchocele.]

[4 Amer. Journal of Med. Sciences, Jan. 1871, p. 80.]

[5 Guy's Hospital Reports, 1871.]

[6 Amer. Journal of Med. Sciences, Jan. 1873.]

[7 Edin. Med. Journal, 1873.]

[8 Guy's Hospital Reports, 3d series, vols. iii. and v.]

[PROGRESSIVE PERNICIOUS ANÆMIA.

By Henry Hartshorne, M.D.

Under this title, Biermer, of Zurich, in 1871, described fifteen cases, observed by himself during several years, as presenting a form of anæmia not accounted for by cognizable causes, but advancing, in spite of treatment, to a fatal termination. Under other names, similar cases appear to have been noticed and reported long before; by Andral, 1823; later, by T. Addison, as Idiopathic Anæmia; by S. Wilks[8] as Idiopathic Fatty Degeneration; by Zenker, of Dresden, in 1856; and by E. Wagner, of Leipzig, 1859–64. Near the time of Biermer's publication, Gusserow, of Zurich, described (1871) five cases of "extreme anæmia of pregnant women;" and Phillips (1873)[4] of fatal fatty degeneration of the heart in pregnant women; all of which pointed the way towards the establishment of a new term in the classification of anæmic affections.

An anomalous place in pathology, however, belongs to this disorder. Immermann[5] insists that no case should be accepted as belonging to it, unless, besides being an instance of extreme and fatal anæmia, it is also "impossible to account, either rationally or empirically, for the progressive course of the anæmic symptoms." Since causation is not capable of being excluded (except by our ignorance) from the history of any disease or group of diseases, any more than from that of other phenomena in nature, it is evident that we must regard the term Progressive Pernicious Anæmia as "a provisional, temporary shelter for a multitude of cases,

[1 Langenbeck's Archiv, Bd. 24, Heft 1.]

[2 Gazette des Hôpitaux, May 6 and 8, 1879.]

[3 Surgery, Am. edition, p. 153.]

[4 Guy's Hospital Reports, 3d series, vol. xviii. p. 159.]

[5 Ziemssen's Cyclopædia, vol. xvi., art. Progressive Pernicious Anæmia.]

possibly of various origin." It seems hardly needful or suitable, however, to go so far as Immermann enjoins, in withdrawing, *ipso facto*, every case from the category of the disease under notice, as soon as its development is traced to agencies whose operation is either rationally or empirically understood. The point in question seems really to be, to ascertain whether there is, or is not, a group of cases whose clinical history is sufficiently peculiar and constant for distinct classification, and whose causation, when ascertained, is, at the same time, in some respects, peculiar and identical; so as to present a true "genus," or class, in pathology. While waiting for more knowledge of their etiology, clinical association affords reason enough for the use of some common name for the cases so represented. But for the now general employment of Biermer's appellation, the term proposed by Addison, Idiopathic Anæmia, might for good reasons be preferred.

Symptoms.—Unless the disease follows some exhausting disorder, its approach is almost always very gradual; the patient becomes pallid; according to the German writers, the appearance of the skin is simply without color, bloodless, as in ordinary extreme anæmia. In France, however, and elsewhere in Europe,[1] and in this country,[2] a dusky or dirty yellow color (*jaune sale* of the French) has been observed in a number of cases. This is, however, not at all the hue of jaundice, of which disorder there are no signs; the conjunctivæ, for example, are not affected. Nor is it the same appearance as the greenish yellow tinge which has given its name to chlorosis. Debility of course attends this spanæmic condition of the body. Palpitation of the heart, dyspnœa upon exertion, and a disposition to faint when slightly fatigued, occur, as in any other form of anæmia.

Digestion is usually a good deal impaired; atonic dyspepsia is so marked a feature of the complaint, that Lepine has referred to it as probably having an important part in its causation. The stomach is irritable; nausea and vomiting are easily provoked, as well as epigastric pain, especially after food has been taken.

Emaciation does not take place in proportion to the anæmia present. Even after death, sometimes, a considerable amount of fat is found in the abdomen and elsewhere. Towards the last, however, in some cases, wasting becomes much more rapid. Œdema of the lower limbs is a usual symptom of a late stage of the disorder. Effusion may occur also in the pleural cavity or pericardium.

Auscultation shows, from a tolerably early period, a loud systolic *bruit de diable*, especially over the base of the heart. Often, also, there is a thrill (frémissement cataire) perceived on palpation of the præcordial region, and, less often, the same with a venous *bruit*, over the jugular veins.

Hemorrhages are frequent in this disease; from the nose, gums, bronchial mucous membrane, &c., and from the uterus in women. Petechiæ (spots), vibices (streaks) and ecchymoses (patches) of hemorrhage in or under the skin, are very commonly met with at a late stage.

More remarkable, although not so often observed, are retinal hemorrhages. In a few instances, the patients have first come under the notice of their medical attendants on account of sudden blindness; shown, by ophthalmoscopic examination, to result from retinal ecchymosis. Where Pernicious Anæmia is suspected, the ophthalmoscope ought always to be used. Spots, small or large, reddish, yellowish, or black, may be seen upon the retina, or else streaks, or irregular clouds of extravasation. Capillary hemorrhages may take place also in different internal organs and cavities of the body. In some cases this has happened in the brain, with the symptoms and fatal result of apoplexy.

Fever is almost always present towards the latter part of the course of Pernicious Anæmia. Along with acceleration of pulse, thirst, and absence of appetite, there are dryness of the skin and considerable elevation of temperature; as high sometimes as 104° Fahr. Different views have been entertained as to the explanation of this pyrexia. To me it appears to be rationably referable to the same causation as that noticed in persons dying of starvation; increased tissue-metamorphosis, under reduction of vital energy. Chemical action here occurs more actively, as the directive and restraining power of the life-force is more and more withdrawn. It is true that the temperature is usually lowered, even excessively (to 95° Fahr., or less), just before death. But this may be understood, partly by the exhaustion, at that time, of most of the rapidly combustible material of the blood; and partly, also, by the failure of respiration and circulation, then, to afford the requisite conditions for calorification. It is known that when the temperature of the surrounding air is high, the heat of the body (as in cases of cholera, reported by Dowler, of New Orleans, and others) has sometimes gone on increasing even after death.

[1 *E. g.*, Copenhagen; Sorensen, Nordiskt Mediciniskt Arkiv, 1877; cited in Dublin Journal of Med. Science, May, 1878.]

[2 J. H. Hutchinson, Med. News and Library, Philadelphia, February, 1879.]

MORBID ANATOMY.—Allusion has been made already to the comparatively slight decree of emaciation in many cases of Idiopathic Anæmia. Dropsical effusions have also been mentioned; they are commonly found after death, more or less considerable in amount, in the chest, abdomen, and cranial cavity. Evidences of extravasation of blood, externally in the skin, and internally in the brain, mucous membranes, ovaries, &c., generally appear. Otherwise the surface of the body, and the tissues of the viscera, are pale and bloodless. The spleen and lymphatic glands, and, in the most typical cases, according to Biermer's and Immermann's limitation, the marrow of the bones, exhibit no morbid alteration. Immermann himself has, however, reported a case[1] in which all the symptoms of Progressive Pernicious Anæmia were present during life, but which he excluded from the category of that disease simply because of tenderness on pressure of the sternum, ribs, vertebræ, &c., and the discovery after death of great overgrowth of the marrow in a number of the bones.

Other pathologists demur to the absoluteness of this exclusion. In a case reported by Pepper,[2] extreme hypoplasia of the bone-marrow, with an excess of lymphoid cells, was found, following a history like that of Idiopathic Anæmia. Pepper inclines, thence, to infer the identity of this disease with myelogenic pseudoleukæmia. In three of Sorensen's cases, previously alluded to,[3] as occurring in Copenhagen, the marrow and substance of several of the bones had undergone morbid changes. Osler,[4] of Montreal, has reported the results of a minute examination of the bones in cases having all the characters of Pernicious Anæmia. He found the medulla of the femur, sternum, and ribs of a jelly-like consistence, not fatty, of a dark-red color, like the splenic pulp. Microscopic examination showed, besides the ordinary granular marrow-cells with distinct nuclei, and smaller cells similar to them, certain colorless cells with clear homogeneous protoplasm and finely granular nuclei; also, what he designates as nucleated red blood-corpuscles; somewhat pale, but exhibiting the elasticity of the red corpuscles of the blood. The nuclei of these corpuscles were large, and often there were two or three in each cell; some of them having a "dumb-bell" shape, as if in the act of division. Others were more deeply colored, corresponding with the so-called "transitional forms" of some physiologists and pathologists. Crystals, such as have been described by Neumann and Charcot as present in similar cases, Osler did not find.

Neumann, who has insisted so much upon the pathogenic importance of bone-marrow changes in leukæmia, regards these changes as, nevertheless, secondary to the anæmia.

One hypothesis proposed by him[1] has been, that, when the blood is deficient in red corpuscles, the ordinary hæmatopoietic function of the medulla of the bones undergoes compensatory exaggeration. Thus results an excessive formation, and conveyance to the blood, of white corpuscles; constituting leukæmia (leucocythæmia).

But the fundamental supposition implied by this hypothesis, namely, that the bone-marrow possesses the function, physiologically, of furnishing corpuscles to the blood, is far from being as yet established. Neumann is quoted by Osler[2] as saying that "to regard the nucleated red blood-cells as transitional forms between colored and colorless elements, involves a theory as to their origin on which I, perhaps, have expressed myself with too much assurance;" and that "it is not improbable that the development of the nucleated red corpuscles may be independent of the colorless marrow-cells."

Some extended investigations made by Litten and Orth, of Berlin,[3] into the condition of the bones after death from various acute and chronic diseases and injuries, have a bearing upon this subject. Examining the bones of 100 persons of both sexes and all ages, they found that in a large majority of cases the femur contained red marrow, to a greater or less extent. This was true of those whose death had been caused by injury, as well as those dying from disease. They found, however, that the deviation from what has been supposed to be the normal state of the medulla took place principally in connection with chronic, and particularly cachectic, diseases, as phthisis and cancer.

In view of such facts, the question appears to be fairly suggested, whether anatomists have, so far, satisfactorily determined what *is* the *normal* condition of human bone-marrow. Nucleated red corpuscles were found by Litten and Orth in all except 8 of their 100 cases examined. In these 8, who were all over 50 years of age, the marrow was purely fatty. In one man, dying at the age of 81, the nucleated corpuscles were found in the bones; these corpuscles were, as reported by the same

[1 Loc. citat.]
[2 J. H. Hutchinson, loc. citat.]
[3 Dublin Med. Journal of Med. Science, loc. citat.]
[4 Lancet, Aug. 3, 1878.]

[1 Berliner Klin. Wochenschrift, 1878, Nos. 6, 7, 9, 10.]
[2 Lancet, loc. citat.]
[3 Berliner Klin. Wochenschrift, Dec. 17, 1877.]

observers, "sometimes found also in the blood." Cells much less deeply colored, and ordinary red blood-corpuscles, were found in large numbers. Litten and Orth conclude that red marrow is, as a rule, displaced by the yellow, as age advances; but that diseases which lead to marasmus are most constantly attended by the development of red marrow in the long bones, and an increase of the nucleated red corpuscles. They regard the changes in the bone-marrow, reported in connection with Pernicious Anæmia, and other anæmic affections, to be secondary to and consequent upon the anæmia. This last view may be accepted as in itself satisfactory, while we are not obliged, at the same time, to accept Neumann's hypothesis, favored by the authors just quoted, that the medullary change indicates an effort of nature to counteract the anæmia by an increased production of blood. The hypothesis of the normal generation of the blood corpuscles by the marrow of the bones has an extremely unphysiological aspect. Upon this view it is relevant to add here that, recently, Pouchet[1] has come to the conclusion, as the result of prolonged experimental and other investigations, that the bone-marrow is not a hæmatopoietic organ. At all events, there does not seem at present any good ground either for referring Pernicious Anæmia to morbid alterations of the bone-medulla as its pathological cause, nor for excluding cases from the list of examples of that disease, because of such alterations having been discovered in them after death.

Changes in the blood in Pernicious Anæmia are readily ascertained by examination during life, as well as *post mortem*. Its appearance is paler and thinner than that of healthy blood; comparable to that of weak coffee, or the washings of meat. The number of the red corpuscles is greatly reduced, sometimes to one-fourth, or even one-twelfth of the normal proportion in the blood. Their size also is altered, both by increase and by diminution (Ferrand, Hayem, Lepine, Quincke, Sorensen); and irregularities occur in their shape, as well as variations in their color. No increase in the number of the colorless corpuscles is observed; this being a pathognomonic distinction between Idiopathic or Pernicious Anæmia and both leukæmia and pseudo-leukæmia (Hodgkin's disease). *Oligocythæmia rubra* (deficiency of red corpuscles) is the term applied by Immermann to this condition of the blood. There appears to be, however, also a diminution of the white corpuscles in some cases, as well as of the albumen and fibrin, and even of the liquor sanguinis as a whole; the actual quantity of blood in the heart and vessels being considerably less than the normal amount.

Fatty degeneration is almost constantly observed, after death from Pernicious Anæmia, in the heart, aorta, other large arteries, the liver, and the kidneys; most marked in the heart. This change has been found to affect particularly the *columnæ carneæ;* a fact which aids in explaining the murmurs heard during life. No valvular disease of any other kind is found, such as the palpitation, murmurs, thrill, and tendency to dropsy have often caused to be suspected. Nor is organic disease of the kidney present; nor any alteration of the lymphatic glands. This last negation, in regard to the glands, according to the generally accepted pathogeny of leukæmia and pseudo-leukæmia, suffices to exclude both of these affections from the diagnosis.

Lastly, one observer, at least, has found, after death from Pernicious Anæmia, decided alterations in the ganglia of the "sympathetic" nervous system. Brigidi[1] reports a careful examination of the cœliac ganglia and their nerves, in a well-marked case of the disease, occurring in a woman aged 53 years. The ganglia presented abundant proliferation of nuclei, with strong pigmentation of the nerve-cells, and great turbidity of their protoplasm. Some groups of cells appeared to be replaced by a sort of granulation tissue of small globular elements. Fatty degeneration also existed in portions of the ganglia; and still more extensively in their nerve-fibres. Brigidi suggests that an explanation of the symptoms of Pernicious Anæmia may be obtained by consideration of the necessary effects of morbid changes in these ganglia. By interference with their regulative and innervating functions, digestion, chylous absorption, and intestinal peristalsis, as well as circulation of the blood and respiration, must be disturbed and impeded. Hence must follow imperfection in the assimilation of food, in oxidation of the blood, and in general nutrition; in a word, anæmia, debility, fatty degeneration, and, finally, death.

ETIOLOGY.—Zenker, Biermer, Gusserow, and Immermann have reported the greatest number of cases of Pernicious Anæmia as occurring in women. Sorensen, however,[2] met with seven cases in men to four in women. Hutchinson,[3] collating the facts concerning thirty-two cases, ascertained that twenty of the patients were males, and twelve females. In regard to age, a similar disparity of experience exists.

[1 La Tribune Médicale, March 30, 1879.]

[1 Lo Sperimentale, May, 1878; cited in London Medical Record, Oct. 15, 1878.]

[2 Loc. citat.] [3 Loc. citat.]

Immermann speaks of the age of from twenty to forty years as the time of greatest liability to the disease. Some other writers assert that it more often occurs in those who have passed middle age. Certainly some have been quite old persons.

Pregnancy, according to all authorities, especially predisposes to it; most of all, rapidly repeated pregnancies. Hemorrhages, uterine or intestinal, or other acute or chronic debilitating diseases; continued privation of blood; long watching with the sick; mental anxiety and grief; these are among the conditions which in a number of cases have preceded the development of this affection. But in many instances no such antecedents have existed; and Immermann particularly asserts, that where such causes have been present, they were, *per se*, inadequate to set up and maintain the incurable and fatal anæmia which constitutes the peculiarity of the disease.

Pathology.—But little more need be said here upon this topic. We can account for death by anæmia, when the body is rapidly and largely robbed of its blood by great or continued hemorrhages. Or, again, when food is withheld, or cannot be appropriated (as in voluntary or involuntary starvation, cancer of the stomach, &c.), inanition produces the same effect. But, here, under the definition of Pernicious Anæmia, without extraneous causation either of inanition or excessive waste of material in the body, the blood-restoring process or function seems to be in abeyance. As already said, neither in the bone-marrow nor in the fatty heart can we find, satisfactorily, the causes, but rather only the consequences of this intense and incurable anæmia. Where is its actual, essential seat? Some suggestions towards the answer to this question may be found, perhaps, in the observation (Brigidi) above referred to, showing morbid changes in the ganglia of the (sympathetic) nervous system of organic life. But the full solution of this problem appears to be yet quite remote.

Diagnosis.—The possibility, in cases having the symptoms described as those of Pernicious Anæmia, that organic visceral disease may be present, must always be carefully considered. Especially should Bright's disease of the kidneys, valvular disease of the heart, and visceral cancer, be eliminated, by the absence of their recognized signs, before Idiopathic Anæmia can be concluded upon.

The affections which present the greatest difficulty of discrimination from this disease are, chlorosis and leukæmia (leucocythæmia). Pseudo-leukæmia (Hodgkin's disease) presents a diathesis in many respects very similar; but its characteristic feature, of general disease and enlargement of the lymphatic glands, is sufficiently distinctive.

Chlorosis is almost invariably met with in females, at or not long after the period of puberty. In it there is, as a rule, no tendency to dropsical effusions; no capillary or other hemorrhages; and no fever. Very seldom does it, for more than a few months, fail to yield to judicious roborant treatment. All these particulars separate it from Pernicious Anæmia.

Leukæmia resembles the latter disease in many features; amongst others, in the comparatively slight emaciation, accompanying very positive anæmia. But, while in leukæmia, there is also obstinate resistance to treatment, and sometimes hemorrhages, and febrile symptoms, it is understood that enlargement of the spleen, either alone or with that of the lymph glands, belongs to leukæmia and not to Pernicious Anæmia. It is the current statement of writers upon the subject, that leukæmia having in some cases a myelogenic origin, sensitiveness of the sternum, ribs, or other bones to the touch should oblige us to fix, in diagnosis, upon leukæmia, excluding Pernicious Anæmia. We have already seen that all observers and writers are not agreed upon this subject. It must be left unsettled for the present. On examination of the blood, in leukæmia, there is found not merely a diminution of the red corpuscles, but a positive excess of leucocytes, above their normal amount.

On the whole, the following are, by general consent, regarded as diagnostic features of Idiopathic or Pernicious Anæmia:—

1. Extreme anæmia, without, or out of proportion to any known past or present occasion either of inanition or waste of material.

2. Very loud and constant cardiac, arterial, and (sometimes) venous murmurs.

3. Œdema of the limbs at a rather late stage; while, at the same time, emaciation is comparatively slight or moderate.

4. Retinal hemorrhages, ascertained with the ophthalmoscope; or in the absence of these, other hemorrhages, or petechiæ, ecchymoses, &c., in or under the skin.

5. Fever, occurring at the time of greatest exhaustion, usually; but sometimes in recurrent exacerbations at earlier periods.

Prognosis.—No anticipation of recovery can be entertained, according to experience so far reported, when the characteristic symptoms of this disease have been fully established. This has been made, indeed, a cardinal part

of the definition and description of the malady.

By the term *Progressive* it has been indicated by Biermer, supported by the German pathologists generally, that an unbroken persistent advance is an essential part of the history of this affection. Wilks, however, in Guy's Hospital Reports for 1857, mentions a case of Idiopathic Anæmia in which a considerable remission, appearing to indicate recovery, took place; the return of the disease afterwards proving fatal. In the same hospital, in 1862, a similar event happened to a patient under the care of Dr. Habershon. Lepine has recognized also the possibility of the occurrence of deceptive remissions; and J. H. Hutchinson[1] reports particulars of a case in which an interval of several months gave an illusory hope of the patient's cure. Still, the general rule undoubtedly is, that a steady, not always very slow, progress goes on, until the enfeebled patient, becoming more and more bloodless, week by week, reaches at last the fatal *syncope*.

Immermann names from six weeks to six months as the usual range of duration of this affection. As we have just seen, in exceptional cases, a considerably longer period of time may be included between its beginning and its termination in death. When it attacks pregnant women, as cases reported show, full term is never reached. Abortion occurs, and the death of the woman follows very soon afterwards. To this there appears to have been, so far, no exception.

TREATMENT.—Hopelessness has been already dwelt upon as belonging to all cases of this disease. Nothing can be suggested different from the remedies and hygienic management set forth in other parts of this work for chlorosis and anæmia, to which those affections ordinarily respond favorably. All such measures, including the transfusion of blood,[1] have been perseveringly tried by numerous practitioners in vain. Yet, as the diagnosis of Pernicious Anæmia requires evidence of incurability for its final establishment, and the disorder otherwise differs from remediable anæmic diseases only in its intensity, obstinacy, and the absence of known causation, it is the obvious duty of the physician, in every case, to use with energy and perseverance those remedies which science and experience have shown to be most available for the enrichment of impoverished blood, and the renewal of the impaired blood-making function.]

[1 Dr. Austen Meldon, in the Med. Press and Circular, October, 1879, asserts that four cases of Pernicious Anæmia have been cured by the *intravenous injection of milk*. In one of these cases transfusion of blood had before been tried without success.]

DIABETES MELLITUS.

By T. LAUDER BRUNTON, M.D., F.R.S.

DEFINITION. — Diabetes Mellitus is a disease characterized by the persistent presence and excessive quantity of sugar in the urine. It is usually attended by dryness of the skin and mouth, thirst, increased appetite, loss of sexual power and desire, muscular weakness, and copious excretion of urine of high specific gravity. It induces emaciation, and death usually ensues from some pulmonary complication, such as phthisis, pneumonia, bronchitis, or œdema, from carbuncles, or from acetonæmia.

HISTORY.—No distinct mention of the disease is to be found in Hippocrates, although certain passages in his writings have been cited as indicating his knowledge of it. Celsus describes it in clear terms, mentioning both the great increase of urine and the wasting of the body, which occur as its most prominent symptoms. The name Diabetes was probably first applied to it about the middle of the first century, A. D.; Aretæus and Galen being the first authors in which we find it thus described. Several of the writers of the middle ages notice it, but no distinct progress in the knowledge of the complaint was made until 1674, when Willis observed the sweet taste and smell of the urine, which he ascribed to the presence of sugar. Morton, in 1675, detected the same properties in the urine of diabetics. Previous writers had over-

[1 Loc. citat.]

looked this, noting only the copiousness of the urine and the wasting of the body. Dobson, Pole, Home, and Cowley proved the correctness of Willis's ideas by actually separating the sugar from the urine.

In 1787 Rollo noticed that vegetable food was injurious in this disease, and introduced an exclusively animal diet as the mode of treatment. Up to this time most physicians had followed Galen, and regarded diabetes as a disease of the kidneys. Rollo's observations, however, showed that the older view of Aretæus, that it was due to disease of the stomach, was more nearly correct. In 1815 M. Chevreul demonstrated that diabetic sugar resembled that obtained from starch. In 1823 Tiedemann and Gmelin found that sugar is a normal product of the digestion of starchy substances; and Ambrosiani, in 1835, showed the presence of sugar in the blood. The researches of Dumas, Bouchardat, Liebig, and others proved that sugar could be changed into lactic acid by means of a ferment, and could be destroyed by means of alkalies. These observations gave rise to two theories; the one that sugar is formed with abnormal rapidity in the intestine, absorbed into the blood, and excreted in the urine; the other, that diabetes is due to imperfect destruction of the sugar, either in the intestine or in the blood. Some held that it underwent conversion into lactic acid as it was passing through the intestinal walls, while others believed it to be destroyed in the blood by means of the alkali therein contained.

It was at this point that the question was taken up by Claude Bernard. He tried to ascertain where the sugar was destroyed by giving it to animals in their food, and testing for it in the blood at various points in the circulation from the intestines onwards through the body. He thus found that when saccharine food was given sugar could be found in considerable quantities in the blood of the portal vein, the vena cava, and the right side of the heart; but that blood taken from the left side of the heart contained only traces of it. From this he concluded that it was absorbed from the intestines and carried by the blood to the lungs, where it was destroyed. But on repeating his experiments with animals deprived of sugar or starch and fed on flesh alone, he still found sugar in the blood taken from the right side of the heart, and on tracing this downwards along the vena cava he discovered that it had entered with the blood of the hepatic vein, which contained it in large quantities. It was also abundantly present in the liver, but it was almost completely absent from the blood of the portal vein, which contrasted very markedly in this respect with similar blood from animals on a saccharine diet. It was evident from these facts that the liver had the power of forming sugar, a function of the organ which had previously been unknown. By passing a current of water through the portal vein, Bernard found that he could remove all the sugar from the liver, but, when the organ was allowed to lie for some little time, sugar again appeared in it, and could again be extracted by washing. As the liver had been taken out of the body before this experiment was performed, it was clear that the formation of the sugar was a chemical and not a so-called vital process; and, as all the blood had been removed from the vessels by the water which had been injected into them, there could be no doubt that the sugar had not been formed from the blood which passed through the liver, but from some substance contained in the hepatic tissue itself. This substance was not diffusible like sugar, or it would have been washed out of the liver along with it. For a short time its nature remained unknown, but Bernard's attention had been attracted by the fact that a decoction of liver had a milky appearance, and this opalescence could not be removed by filtration. On adding alcohol to the decoction, a white flocculent precipitate was thrown down. This substance closely resembled starch in its chemical composition, and as it was readily transformed into sugar by boiling with dilute acids or by the action of various ferments such as vegetable diastase, saliva, or pancreatic juice, Bernard called it glycogen, and by this name it is now generally known. Hensen, of Kiel, discovered it independently almost at the same time as Bernard. Even before he succeeded in isolating glycogen Bernard noticed that the decoction obtained from the liver of an animal fed on sugar and starch was quite milky, while that got from an animal which had been fed on flesh alone was only slightly opalescent. This difference in opalescence indicated that in the former case the liver contained much, and in the latter little, glycogen. He also observed that the amount of sugar in the hepatic vein was nearly equal in both cases, although in the one the animal had got no sugar in its food, and in the other a great deal. He was thus led to regard the liver as having a second function, that of arresting sugar on its way from the intestine into the general circulation. As this function is performed by the conversion of the sugar into glycogen, he terms it the glycogenetic function; while the conversion of glycogen into sugar again is known as the glycogenic function. But his ideas have not been accepted unquestioned. First it was said that the liver does not form sugar at all. The chief supporters of this doctrine were Figuier and Sanson.

Figuier thought that the sugar found in blood of animals fed exclusively on flesh was derived from sugar contained in the flesh itself, and simply absorbed during digestion. Its apparent absence in the portal vein he attributed to its reactions being masked by some substances such as certain albuminous products of digestion which were contained in the portal blood and prevented its detection; but Bernard showed that notwithstanding the presence of these substances sugar could be found in the portal blood of animals fed on a mixed diet, and Dumas, that sugar could not be detected in it by fermentation when the diet consisted of flesh only. Sanson took up a somewhat similar position to Figuier, but with a little difference, necessitated by Bernard's discovery of glycogen. Instead of the glycogenic he attacked the glycogenetic doctrine, and instead of maintaining that the liver took sugar from the portal blood, and after retaining it a little while, gave it off again, he said that glycogen was only dextrine which the liver had abstracted from the portal blood and transformed a little more actively into sugar than other tissues could do. The other tissues, however, had a similar function, and this dextrine, which was a vegetable product, formed a constituent of blood and flesh, and thus during digestion found its way into the portal blood of carnivora. This objection was, however, refuted by Messrs. Bouley, Poggiale and Longet, who were appointed by the Académie de Médecine to inquire into it. They found no glycogen in ordinary butcher-meat, but obtained it largely from the livers of dogs fed upon it. They did not find it, however, in the muscles of such dogs. In the flesh of horses it was constantly found, and probably it was this fact which led M. Sanson, who had made his experiments in the veterinary school at Toulouse, to raise his objections to Bernard's theory. The most formidable opponent of Bernard is Pavy, who was formerly his pupil and a strong supporter of his theory. On repeating Bernard's experiments he was struck by his failure to get anything more than traces of sugar from the blood of the right side of the heart; and at last began to think that the sugar-forming function of the liver was not exerted during life, but was a post-mortem phenomenon and only occurred under exceptional circumstances while the animal was alive. Pavy's observations regarding the small quantity of sugar present in blood drawn from the right side of the heart, and the almost entire absence of it from the liver when removed immediately after death, have been confirmed by many observers, Marcet, MacDonnel, Jaeger, Meissner, Ritter, Schiff, Tscherinoff, Eulenburg, Flint, and Lusk. It is to be remembered that by passing a stream of water through its bloodvessels Bernard succeeded in washing the whole of the sugar out of a liver after death, when, according to Pavy, the transformation of glycogen into sugar is going on most quickly. Flint has explained the absence of sugar from a liver during life, or one removed from an animal the instant it has been killed, and while circulation is still going on, by supposing that the great mass of blood which constantly passes through that organ washes out the sugar as fast as it is formed; but after death, or when the circulation is interfered with, the transformation of glycogenic matter into sugar goes on. The sugar is not removed under these conditions, and can then be detected in the liver. This explanation reconciles to a great extent the conflicting observations.

ETIOLOGY.—*Sex.*—This disease occurs more frequently among men than women in the proportion of about three to one, as appears from the annexed table of the numbers given by various observers. This proportion would of course be very greatly altered if the cases of glycosuria which occur during pregnancy and lactation were included, but these cases are omitted because they differ so much in symptoms and prognosis from true diabetes that they can hardly be classed with it. It must also be remembered that the urine of men is much more readily obtained by the physician than that of women, and that the disease may sometimes be overlooked in the female when it would have been detected in the male; but these cases cannot be sufficiently numerous to influence greatly the proportion already given:—

Name of Observer.	No. of Cases.	Men.	Women.
Griesinger . . .	225	172	53
Zeminer	62	49	13
Seegen	140	100	40
Betz	31	24	7
Schäfer	49	36	13
Leudet	41	24	17
Schmitz	104	77	27
Durand-Fardel . .	334	256	78
	986	738	248

Age.—It occurs at all ages from childhood up to advanced old age, but is most common during adult life. The time of its appearance seems to be modified by the sex and condition in life of the patient. In a table given by Griesinger, the maximum number of cases occurred among men between thirty and forty years of age, whilst among women the greatest numbers were equally distributed between

the two decades from ten to twenty and from twenty to thirty. Amongst the cases observed by M. Durand-Fardel the number of females affected by the disease between the ages of ten and twenty was greater than that of the males in the same decade as well as that of the females in the two succeeding ones. While amongst hospital patients it occurs most commonly between thirty and forty, it is found more commonly at a later period amongst persons of higher rank and easy circumstances; the decade from fifty to sixty being that of its maximum frequency. The following table represents the frequency at different ages in a total of 618 cases collected by different observers:—

Age.	Seegen.	Schäfer.	Leudet.	Schmitz.	Durand-Fardel.	Total.
0—10	—	3	—	1	—	4
10—20	5	11	—	8	10	34
20—30	23	4	2	9	11	49
30—40	21	7	2	16	37	83
40—50	23	5	6	16	92	142
50—60	43	1	12	38	101	195
60—70	14	2	10	12	47	95
70—80	1	—	8	4	2	15
80—90	—	—	1	—	—	1

Heredity.—The influence of heredity is not often marked, for while in some cases parents and children have both had this disease, in the great majority the children do not have it. But although it is not frequently hereditarily transmitted, the tendency to it may appear very strongly in a single generation, and several brothers or sisters in the same family may suffer from it. So much is this the case that Bouchardat states that his knowledge of the fact led him to discover the disease in a brother of one of his patients who had no suspicion that he was suffering from it.

Temperament.—The disease is very commonly met with amongst stout muscular and obese persons, often of a gouty habit, and especially those who have a tendency to accumulate omental fat. It also occurs, but more rarely, in an entirely different class of thin spare and active persons, with a tendency to neuralgia and other nervous troubles.

Habits.—Sedentary habits of life and free indulgence in the pleasures of the table appear favorable to the development of diabetes. It occurs most commonly amongst private gentlemen, priests, lawyers, and doctors; and is less frequent among men engaged in active bodily exercise.

Race seems to have some influence upon it, for while it is exceptional among negroes it is very common among Jews. This may, however, be simply due to the habits of the races, for while negroes are chiefly employed in manual labor, Jews generally engage in sedentary pursuits such as banking and commerce.

Climate.—It is difficult to estimate the influence of climate, because the diagnosis of the disease depends so much upon the medical men who reside in any particular country or district. If their medical training has been thoroughly good, they will recognize the disease when it will be passed over unnoticed by others, the deaths really due to it being ascribed to phthisis or other diseases merely consequent upon it. Moreover, the complaint will be influenced by other causes than that of climate, such as the food of the inhabitants, or their manner of life and general circumstances. It is said to be very rare in Holland, Russia, Brazil, and the Antilles, and more common in England, France, certain districts of Germany, as Thuringia and Wurtemberg, and of India, and especially in Ceylon. It is said to be very common in Normandy and in the agricultural districts of England.

Exciting Causes.—Amongst the exciting causes are injuries to the head and general shock, and occasionally also injuries to other parts of the body, nervous affections, especially tumors. Softening and degeneration of the brain or medulla oblongata seems also to have a powerful influence. The occurrence of the disease not unfrequently appears to date from violent and depressing emotions, and it is said to be more than usually frequent in times of great commercial depression, when such emotions are likely to be more generally prevalent. Excessive mental exertion, even when unaccompanied by worry, has sometimes been adduced as a cause, and some cases seem to arise from severe bodily exertion and sexual excesses. The influence of food is by no means certain, for although a large proportion of starch and sugar in food has been regarded, and apparently with great probability, as a cause of diabetes, yet it is not possible to produce the disease in animals by a rigid diet of this sort, and the number of persons who live almost exclusively on such a diet is very large. Nevertheless, the occurrence of the disease, es-

pecially in certain localities, would seem to favor the opinion; and so also does the fact that it has been observed to come on after a sudden change from an animal to a vegetable diet, and to disappear when the use of animal food was resumed. Exposure to cold, especially during the period of menstruation, seems to have brought it on in certain cases, and it has not seldom been observed to come on during the course of recovery from febrile diseases, especially during convalescence from ague.

SYMPTOMS.—The chief symptoms which induce patients to seek for medical advice in cases of diabetes are either increased thirst, commencing emaciation or muscular weakness while the appetite continues good or even excessive. Sometimes, too, attention has first been drawn to the disease by the existence of a cutaneous eruption, such as eczema of the vulva, or boils and carbuncles. The disease generally begins insidiously, and continues for a considerable time before those suffering from it think of seeking advice. Sometimes indeed it may continue for years without the patient's being aware of its existence, its long continuance being only ascertained by the patient's recollection that his urine had left white spots on his dress or on the ground during a certain period, he not being aware of the cause. At other times its onset is somewhat sudden, and excessive thirst or emaciation is observed to come on shortly after severe mental anxiety or work, after an injury or concussion, or after convalescence from some febrile disease. It has already been mentioned that two types of persons seem especially liable to diabetes, viz., the stout, obese, and somewhat lymphatic, and the thin and nervous. It has seemed to the writer that the symptoms which indicate the commencement of the disease are different in these two types—thirst and emaciation being observed in those who belong to the lymphatic class, while muscular weakness and lack of energy first attract attention in those belonging to the nervous type. The number of cases he has as yet observed is too small to enable him to come to any definite conclusion concerning the uniformity or significance of this relation.

The symptoms of indigestion and nervous derangement have been mentioned as preceding the onset of the disease, or occurring during its very early stages, but it is difficult to say whether these are really part of the disease, and not rather its cause. The urine in diabetes is very greatly increased in quantity, often amounting to 80 or 100 ounces a day; it is generally of a pale color, and a peculiar odor, differing from that of ordinary healthy urine, and something like that of whey. Its specific gravity is generally very high, usually ranging between 1030 and 1040, sometimes rising to 1045, or even 1050. It is often strongly acid. From the sugar it contains, it has sometimes a distinctly sweet taste, although occasionally this may be masked by its saline taste. A drop of it, falling upon the clothes or upon the ground, leaves, after evaporation, a white spot of sugar. When kept for several days, fungi are apt to grow upon it.

Although the increase in the quantity of urine is generally so great as to form a marked feature in the disease, yet sometimes its amount does not exceed the normal. The general symptoms are such as we should almost be led to expect from the drain of so much water and saccharine matter from the system. The thirst is generally very great, and the quantity of water drunk is often enormous. It has been said that the quantity of urine excreted by patients is greater than that of their beverages, but this can hardly be the case, and the observations which seem to support this view have probably been made for too short a time, the apparent excess being most likely derived from water lodged in the system. The thirst has been attributed to the necessity of water for the transformation of starch into sugar in the intestines, but it is rather due to the quantity carried out through the kidneys by the sugar in the process of excretion.

The author has observed that at least one diuretic, digitalis, has a similar power of causing thirst. Some years ago, when experimenting with this drug, and taking every day a measured quantity of fluid, the excretion of urine was greatly increased on one occasion by the use of digitalis. Shortly afterwards intense thirst came on, which obliged him to drink more than his usual allowance.

In addition to thirst, there is generally a dryness of the mouth. This has no direct relation to the thirst, and may even be present without it. This dryness in the mouth is more marked in the morning on awaking, and may be so severe as to interfere with articulation. The tongue is generally red, abnormally clean and fissured. Sometimes it is covered with a whitish and somewhat dry coat—sometimes a thin white fur shows itself in longitudinal streaks along the dorsum, and especially in the edges. Sometimes, however, the tongue is of a blackish color, and may be dry and hard, or deeply fissured. Sometimes it is covered with large rough papillæ, and sometimes is sticky to the touch, seeming to the patient to adhere to the palate. The reaction of the saliva is generally acid; the gums are soft and somewhat livid, but sometimes pale. The teeth may become loose and seem to

have been pushed upwards from the retraction of the gums. The odor of the breath is peculiar, and has been compared by some to hay, and by others to ripe apples. A disagreeable taste in the mouth is sometimes complained of, while by others the sweet taste of sugar is distinctly perceived. The appetite is generally increased, as one would expect from the necessity of supplying the body with nutriment to supply the want occasioned by the drain that is constantly kept up by the excretion of sugar. In some cases it is merely good, but not excessive, whilst in others it is perfectly ravenous. Towards the termination of the disease, when complications set in, digestion fails, and the appetite may sink under the normal, or disappear altogether. In some patients a great desire for fatty food has been noticed. The digestion is generally good, but as the disease continues, symptoms of dyspepsia, such as flatulence, epigastric pain, and vomiting often occur. The bowels are frequently constipated. The skin is dry, wrinkled, and scaly in the advanced stages of the disease, but at its commencement the secretion of sweat may be normal or even excessive. The sweat is acid; it has the same odor as the breath, and has been found to contain sugar. Not unfrequently cutaneous eruptions of pustules or reddish or brown spots are observed on the body, thighs, and legs. Excoriation of the prepuce or eczema of the vulva frequently occurs from irritation of the parts by the saccharine urine. Although boils may occur at the very commencement of the disease, it is especially in the later stages that they and carbuncles become very common. The occurrence of either in a robust elderly man ought at once to lead to an examination of the urine. The lungs, at the beginning of the disease, are generally normal, except that the respiratory sounds are rather weak, especially towards the apices; but during the progress of the malady, exaggerated respiration, without any physical sign, has occasionally been observed, and very frequently the signs of pulmonary phthisis appear. The amount of carbonic acid excreted and of oxygen inhaled is less than usual, and it has been found by Pettenkofer and Voit that diabetic patients lose the power (which healthy persons possess) of storing up oxygen in the body during the night for utilization during the day. The general nutrition of the body may, as has already been observed, continue unimpaired for a number of years, but, in the advanced stages of the disease, even the increased appetite is insufficient to compensate for the constant loss of sugar, and emaciation occurs. One of the first symptoms of the disease is often loss of sexual appetite and power, and when this does not occur at the commencement, it generally comes on during the progress of the disease. Nervous disturbances are of frequent occurrence in diabetes, one of the most common being languor and incapacity for work, either bodily or mental, and there is frequently an irresistible desire to sleep after meals, which may, however, be due in a great measure to the sleep during the night being disturbed by the frequent calls to micturition occasioned by the profuse secretion of urine. The memory frequently fails, the patient becomes irascible, melancholic, and hypochondriacal. Pains are not unfrequently complained of in the lumbar region, in the back, legs, and joints, or chills or heat are felt in the extremities. Cramps in the legs are very common, especially at nights; hyperæsthesia is rare, but partial anæsthesia is sometimes noticed.

Progress, Duration, and Termination. — It has already been mentioned that in many cases the disease may exist for several years without the patient being aware of its existence, and its progress in such cases seems to be exceedingly slow—indeed, for a long time it may remain almost stationary, even although no special treatment be adopted. In the generality of cases it progresses steadily onward, unless it be arrested by appropriate treatment; the daily loss of nutritive material in the urine becomes greater and greater, until at length the increased appetite is insufficient to supply it, emaciation begins, complications set in, and death closes the scene. Intercurrent attacks of febrile disease diminish the amount of sugar excreted, but they do not exert much real influence upon the malady, and the sugar again increases when the temperature falls. The duration of the disease is usually long, although cases have been recorded in which it seemed to run a course of only a few weeks before phthisis set in. The usual term of the disease is said by Griesinger to be between two and three years. In many instances, however, when an appropriate treatment is rigidly pursued, its duration may be very greatly increased, so much so that, according to Bouchardat, a diabetic properly treated has as much chance of living a long time as a man in good health.

Death usually results from some complication of diabetes, the most common causes being phthisis, pneumonia, carbuncle, or gangrene. Occasionally, however, diabetic persons rather suddenly become short of breath and drowsy, and the drowsiness rapidly deepens to coma, ending in death within a day or two of the onset of these symptoms. The peculiar condition suggests very strongly the action of a narcotic poison. It has been ascribed to uræmia, but all other evidence of

uræmia is wanting, and a more plausible theory, in support of which much evidence has been accumulated, attributes it to the formation of a poisonous substance, acetone, by fermentation. The condition has therefore been termed "acetonæmia" (see Pathology).

Complications.—The complications of diabetes are such as arise from imperfect nutrition of the tissues showing itself in a tendency to inflame and slough. This tendency exhibits itself in the skin and subcutaneous cellular tissue, in the formation of boils, carbuncles, and superficial ulcerations upon various parts of the surface, and gangrene of the extremities resembling senile gangrene. The boils may appear in great numbers in the early stages of the disease before any of the other symptoms are present, and may first awaken suspicion regarding the nature of the disease. Carbuncles, on the other hand, generally come in the later stages, and are not unfrequently the immediate cause of death. Pneumonia, gangrene of the lung, and phthisis, often occur, the latter being the usual termination of diabetes. Disorders of vision are very common. Dimness of vision (amblyopia) occurs according to Bouchardat in about one case in five. It is generally transient, although it may recur. When it becomes permanent it is usually the forerunner of death. Cataract sometimes follows one or two attacks of temporary amblyopia, but sometimes appears without any previous failure of vision. It generally comes on after the disease has existed for some time, and may come on either gradually or quickly, and involve either one or both eyes. The author has seen it come on very shortly after the appearance of diabetic symptoms in a girl of fifteen years of age. It is nearly always of the soft kind.

Diagnosis.—The diagnosis of diabetes depends upon the detection of grape sugar in the urine. The three conditions with which it may be most readily confounded are diabetes insipidus, temporary glycosuria, and hysteria. Diabetes Mellitus and Diabetes Insipidus resemble each other in the large quantity of urine passed by the patient, but in the former the urine contains grape sugar, while in the latter it does not. Glycosuria is much more likely to be confounded with diabetes, and, in fact, is constantly mistaken for it. The distinction between them is that glycosuria is a temporary, passing condition, and the quantity of sugar present in the urine is small. In diabetes, on the contrary, the sugar is permanently present, and is in considerable quantity. Glycosuria occurs almost as a normal condition in pregnant women, and sugar may occasionally be distinctly perceived in the urine after meals which consist of much saccharine and farinaceous food, although the persons are not diabetic. Sugar may also occur temporarily in the urine in cases of intermittent fever. In all those diseases the distinction between them and diabetes may be observed both by a continued examination of the urine, and by the absence of the other symptoms of the disease. The urine in them is not increased above the normal quantity; its specific gravity is not abnormally high, there is no emaciation, no excessive thirst, and no excessive appetite. Hysterical patients sometimes simulate diabetes, and the detection of the fraud is not always easy. They generally are unaware of the distinction between cane and grape sugar, and their urine, though sweet to the taste, and of abnormally high specific gravity, does not reduce Fehling's solution when boiled with it. If the urine, however, be first boiled for a few minutes with a drop or two of strong sulphuric acid, then neutralized with liquor potassæ and again boiled with Fehling's solution, reduction will take place, the cane-sugar having been converted into grape-sugar by boiling with the acid. A very instructive case has been recorded by Abeles. A lady came to Carlsbad complaining of diabetes, from which, as she alleged, she was suffering. On testing the urine in the manner just mentioned, it was found to contain cane-sugar, and not grape-sugar. On the physician informing the lady of his discovery of the imposition which she was practising, she left Carlsbad in great disgust, but returned the following year. On this occasion the specific gravity of the urine was as high as before, and it contained grape-sugar instead of cane-sugar. On testing the urine, however, by a polarizing apparatus, Dr. Abeles found that the angle of polarization corresponded with that of a solution of ordinary commercial grape-sugar, but not with that of diabetic sugar; and he intimated to the lady that he could only be satisfied regarding the nature of the disease by drawing a portion of the urine directly from the bladder for analysis. This she was willing to allow, but stipulated that it should be done at an hour to be fixed by herself. The urine which was drawn off by the catheter contained a very much larger proportion of grape-sugar than any which Dr. Abeles had previously analyzed. The lady had actually gone to the trouble of introducing lumps of grape-sugar into the bladder. In consequence of the irritation thus produced, catarrh of the bladder came on.

Pathological Anatomy.—The pathological appearances found on post-mortem examination of diabetic cases are

by no means constant. They may be divided into two classes, those which may be supposed to have occasioned the disease, and those which may be regarded as consequent upon it. Amongst the former the appearance of the liver naturally first attracts attention. In many instances the organ appears quite normal. Not unfrequently, however, it appears enlarged and congested. The congestion is apparently equally diffused, has a light rosy tinge over the whole organ, and the acini appear, both in the natural surface and in the section, as sharply marked rosy specks, on which the fully-dilated capillaries can be recognized by means of a magnifying-glass as a thick network of red lines. The hepatic vein and its roots are not dilated. The enlargement of the liver is partly due to the congestion and partly to the enlargement of the glandular elements. The liver cells in the peripheral part of the acini are more rounded, the angles less sharp, the contents granular, and the nuclei large and distinct. Those in the middle part of the acinus which is supplied by the hepatic artery are fatty, those in the central district around the radicles of the hepatic vein are almost normal. In the periphery of the acini there seems to be an increase in their size, and also a formation of new cells, a microscopic section presenting large cells with several nuclei, and also young cells. The intercellular connective tissue is usually unaltered. At other times, however, it is increased, and the organ is dark and tough. Occasionally fatty degeneration has been observed. The pancreas is stated by Niemeyer to be not unfrequently hypertrophied, but according to other observers is oftener atrophied, the atrophy sometimes affecting the whole gland, and at other times only its tail, leaving the head of the gland unaltered. Cystic degeneration of the gland has also frequently been observed, and is possibly due to obstruction of a duct. In one case Seegen found fatty degeneration of the epithelium of the gland, and in another, obstruction of the duct by calculi, these being probably early conditions of the atrophy which occurs in the later stages. In the intestinal tract proliferation of the epithelium has been observed along almost its whole course, on the tongue, stomach, and intestine itself. The mucous membrane is thickened, and sometimes also the muscular coat. The surface is at times hyperæmic. The blood, as a rule, contains a larger quantity of fat than usual—so much so, that the serum sometimes appears milky. The heart is often fatty, and the vessels atheromatous, the small and moderately-sized vessels being more affected than the large ones. Those at the base of the brain and in the retina seem especially liable to atheroma.

The nervous system is very frequently the seat of lesions in diabetes, although these are neither very definite as to character nor seat. These may be conveniently arranged in physiological order, taking first the medulla oblongata, then the sympathetic and splanchnics, which contain the vaso-motor nerves to the liver, and then other parts of the nervous system.

The medulla oblongata has been found to be affected in a number of instances, sometimes by degeneration, sometimes by the pressure of a tumor, sometimes by clots or by inflammatory softening. Dickinson has noticed dilatation of the arteries and of the perivascular spaces. These are so large as to be perceptible to the naked eye, and contain blood more or less altered, according to the duration of the case. It appears to have left the vessels by diapedesis rather than extravasation. He considers this condition to be peculiar to diabetes, and has found it not only in the medulla oblongata, but in the pons and other parts of the brain, as well as the spinal cord. It has, however, been noticed in persons who were not diabetic, and has been found to be absent in some who were.

The sympathetic in the abdomen has been observed to be much thicker than normal, and the semilunar ganglion and splanchnics have been found thick and cartilaginous. Atrophy of the cells in the solar plexus has also been noticed. The vagi have been observed to be thickened in some instances, and in others atrophied from the pressure of concretion. The meninges of the brain have been found congested, adherent, or œdematous, and tuberculous deposits have also been discovered in them. Induration, hemorrhagic infarcts, softening, and tumors have been observed in various parts of the brain, in the cerebellum, and in the pons. The spinal cord has in some cases been found hardened, in others softened; and Dickinson describes in it the same dilatation of the perivascular spaces as in the brain, and also enlargement of the central canal and proliferation of the epithelium lining it.

The kidneys are usually large and hyperæmic. The tubules show increased proliferation and often fatty degeneration of the epithelium. The lungs are generally diseased, though sometimes they present little or no change in cases where the disease has terminated in acetonæmia. The most usual alterations in the lungs are of a pneumonic character, portions of the lung being found in various stages of pneumonic change, red, gray, or ulcerated. The excavations are often large, and surrounded by thickened and indurated tissue. The lesions are thus chiefly those of chronic pneumonia, but true tu-

berculosis also occurs. Sometimes gangrene of the extremities is observed, and not unfrequently carbuncles have been found, which have made their appearance before death, and have indeed hastened the fatal termination. Inflammation of the aponeuroses, tendons, and bones also appears in some cases.

PATHOLOGICAL CHEMISTRY.—It may perhaps render the relation between the nature of the food and the formation of sugar in the body more comprehensible if we preface the consideration of this subject by a few words on the general relations of sugars and starches. These bodies are frequently termed carbo-hydrates, because they contain hydrogen and oxygen in the proportion to form water united with carbon. They may be divided into three classes—(1) sucroses, or the sugars proper; (2) glucoses, or grape sugars; (3) amyloses, or starch and woody fibre.

Each of these three classes contains several distinct substances having the same percentage composition :—

1. *Sucroses.*	2. *Glucoses.*	3. *Amyloses.*
$C_{12}H_{22}O_{11}$	$C_6H_{12}O_6$	$C_6H_{10}O_5$.
Sucrose +	Dextrose +	Starch +
(or cane sugar).	(or grape sugar).	Glycogen +
Lactose +	Levulose —	Dextrin +
(or milk sugar).	(or fruit sugar).	Inulin —
	Galactose —	Gums
	Inosite.	Cellulose.

Many of these bodies have the power of turning the plane of polarized light to the right or left, and this property is of considerable use in distinguishing them one from another. Those which turn the plane to the right hand are marked in the preceding table with +, those which turn to the left with a —.

The best known of the sugars is cane-sugar, or sucrose. It is readily soluble in water, and it has the power of rotating polarized light to the right, its power of rotation being 73·8. When its solutions are boiled for a long time alone, or for a short time after the addition of dilute sulphuric acid, it is split up by taking a molecule of water, and yields equal parts of dextrose and levulose, according to the following formula :—

$$\underset{\text{Sucrose.}}{C_{12}H_{22}O_{11}} + H_2O = \underset{\text{Dextrose.}}{C_6H_{12}O_6} + \underset{\text{Levulose.}}{C_6H_{12}O_6}.$$

It does not ferment directly, but by the action of yeast it splits into dextrose and levulose in the same manner as when boiled with sulphuric acid, and these bodies are both capable of undergoing fermentation. When boiled with an alkaline solution of a salt of copper, it decomposes the copper salt slowly and imperfectly, while solution of dextrose does so rapidly.

Lactose, or milk-sugar, is less soluble than sucrose, and not so sweet. It rotates the polarized light in the same direction as sucrose, but to a less extent, its power of rotation being 59·3. When boiled with dilute acids, it yields a peculiar glucose called galactose.

The most important member of these groups in relation to diabetes is dextrose, or grape-sugar. It is readily soluble in water, from which it crystallizes in cauliflower-like masses; it is less sweet than cane-sugar. Its solution deflects the plane of polarized light to the right. When its solution is mixed with yeast, it rapidly undergoes fermentation, carbonic acid being given off, and alcohol remaining in the solution. It is decomposed, when in solution, by alkalies, the liquid becoming first yellow, and then brown. It is easily oxidizable, and therefore quickly reduces an alkaline solution of metallic salts, such as those of copper. Levulose resembles glucose in its reactions, but deflects the ray of polarized light to the left. This deflection to the left is much stronger than that of dextrose to the right, so that when equal quantities of these sugars are present in solution, deflection to the left occurs. This happens, for example, when cane-sugar is boiled with acids, or treated by the intestinal ferment, as it then splits up so as to yield equal quantities of dextrose and levulose. It is possible, however, to make a mixture of dextrose and levulose in such quantities that the rotatory powers will counteract each other, so that the solution will have no action on the polarized ray, although it contains a large quantity of sugar. Such a condition as this might occur in a diabetic patient after taking a quantity of cane-sugar, and this is probably the explanation of a case recorded some time ago, in which the urine had no effect upon the ray of polarized light, although it reduced copper strongly. When yeast is added to its solution, it undergoes fermentation, and splits up so as to yield chiefly alcohol and carbonic acid :—

$$C_6H_{12}O_6 = 2C_2H_6O + 2CO_2.$$

Inosite is found in various animal tissues, and is thus often designated muscle sugar. It exists also in vegetables, and is obtained in considerable quantities

from beans. It has no action on polarized light, and although it causes hydrated oxide of copper to resolve, it does not reduce it on boiling, nor does it undergo fermentation with yeast. In one case at least, observed by Kühne, and in which the urine was occasionally analyzed by the writer, inosite appeared alternately with grape sugar in the urine of a patient. In testing for inosite the urine is precipitated first with neutral acetate of lead, and then with basic acetate. The second precipitate is collected on a filter, suspended in a little water, and decomposed by hydric sulphide. The solution is filtered and evaporated to a small bulk. A drop is then evaporated with nitric acid almost to dryness, on a piece of platinum foil. Ammonia and a solution of calcium chloride are added to the residue, and the whole gradually evaporated to dryness. If inosite be present a rose-red tinge will appear. It is still a question with some chemists whether another sugar should not be added to this group, viz., diabetic sugar; for although it is usually believed to be identical with glucose, this doctrine is not universally accepted, and it is quite possible that the progress of physiological chemistry may show that these sugars are distinct.

The physical properties of starch are well known. When heated with dilute sulphuric acid, or acted upon by certain ferments, as diastase, it divides into dextrin and dextrose :—

$$\underset{\text{Starch.}}{3(C_6H_{10}O_5)} + H_2O = \underset{\text{Dextrin.}}{2C_6H_{10}O_5} + \underset{\text{Dextrose.}}{C_6H_{12}O_6}.$$

Dextrin derives its name from its powerful action on polarized light, its rotatory power being + 138° 7′. It is generally prepared by heating starch to about 150 degrees. It is very soluble in water, from which it is precipitated by alcohol, and it is converted into dextrose by boiling with dilute acids. There are two varieties of dextrin, one of which gives no color with iodine, and has therefore been named by Brücke achrodextrin; the other gives a wine-red color with iodine, and is therefore called erythrodextrin.

Glycogen, when pure, forms a white, amorphous powder, dissolving in water, and giving an opalescent, milky solution. With iodine it gives a brown, red, or violet color. It does not reduce an alkaline solution of hydrated oxide of copper, nor does it ferment with yeast. By boiling with diluted sulphuric acid, or by the action of diastatic ferments, such as diastase, ptyalin, or pancreatic ferment, it is converted into dextrose.

Tests for Sugar.— When sugar is burnt, it is converted into a substance called caramel, which has a peculiar distinctive odor. Upon this depends a simple test for its presence. A piece of blotting-paper soaked in the urine, dried, and held sufficiently near the fire or over a lamp to decompose the sugar, if it be present, will give the smell of caramel. This, however, is not very commonly employed. The four tests in general use are those of Moore, Trommer, Fehling, and the fermentation test.

Moore's Test.—In employing this test, equal parts of urine and of liquor potassæ are mixed in the test-tube, and the mixture heated to boiling. The sugar is thus decomposed, and yields glucic and melassic acids, which give a brown color to the liquid, the tint varying in depth from a light brown almost to black, according to the amount of sugar. It is best not to boil the whole of the liquid, but only to heat the upper half of it, so that the color of the lower half, remaining unchanged, serves as a standard wherewith to compare that of the upper. Any change in tint caused by the boiling is thus more readily detected.[1] The coloring matter of the urine also gives a yellow color when boiled with potash. A high-colored urine, therefore, may appear to contain a little sugar when it does not, and, to avoid this source of fallacy, the urine may be decolorized by shaking with animal charcoal and filtering. The yellow color due to the action of potash on the coloring matter of the urine becomes lighter as the mixture cools. That due to sugar, on the contrary, becomes darker on cooling, and thus the one may be distinguished from the other.

Dr. Meymott Tidy has proposed to employ the method for quantitative analysis by means of a color scale; but the method is not sufficiently accurate to be of use, except as affording a rough approximate indication of the amount of sugar present.

Trommer's Test. — This test depends upon the property which sugar possesses of deoxidizing metallic salts, so that when boiled with a solution of cupric hydrate it reduces it to cuprous oxide. In using this test, a drop or two of dilute solution of copper sulphate is added to the urine in sufficient quantity to give a faint but distinct blue color to it, and then a quantity of liquor potassæ equal to that of the urine is mixed with it. If no sugar be present, a pale blue precipitate of cupric hydrate is thrown down, and does not dissolve on shaking; but if sugar be present, the precipitate re-dissolves, forming a rich blue solution. On then heating, the cupric hydrate is deoxidized, and a precipi-

[1] Dr. Gowers informs me that he has found that when a lemon-yellow tint is got with this test, the sugar contains about 5 grains to the ounce, 10 grains give a light sherry tint, 15 a dark sherry tint, and 20 or over a port-wine color.

tate of yellow or orange-red cuprous oxide is thrown down.

Fehling's Test.—When the quantity of sugar is very small, it may happen that the whole of the cupric hydrate in Trommer's test may not be dissolved, and may interfere with the reaction. It is, therefore, convenient to have a liquid containing the cupric hydrate already dissolved. Several substances besides sugar cause cupric hydrate to dissolve in an alkaline solution, and amongst these is tartaric acid. Fehling's solution is of a deep blue color, and when added to urine and boiled, gives a precipitate of cuprous oxide in the same way as in Trommer's test. The disadvantage of this solution is that it is apt to undergo change, and when old will deposit cuprous oxide, although no sugar be present. When using a solution, therefore, which has been made for some time, it is always well to boil it alone, to see that it does not deposit cuprous oxide, before using it as a test for sugar. Should it deposit when boiled, a little caustic soda or potash added to it will again render it fit for use.[1]

Fehling's solution is prepared by dissolving 34·64 grammes of pure crystallized cupric sulphate, powdered and dried between folds of blotting-paper, in 200 cc. of distilled water. In another vessel 173 grammes of Rochelle salts are dissolved in 480 cc. of a solution of caustic soda sp. gr. 1·14. The solutions are then mixed and diluted to one litre with distilled water.

Fermentation Test.—The easiest method of applying this is to mix the urine with a little brewer's yeast, and put it in a test-tube closed by a well-fitting cork, through which a piece of glass tubing passes nearly to the bottom of the test tube. If the urine contain sugar, it will be decomposed by the yeast, and yield carbonic acid, which, if the tube be kept in an upright position, will accumulate under the cork, and by its pressure gradually drive the liquid out through the tube.

Several other qualitative tests for sugar have been proposed, but are comparatively rarely employed. Among others we may mention those of Böttger, Krause and Luton, Maumene, and Mulder.

Böttger's Test consists in mixing urine with a strong solution of carbonate of soda, adding a little subnitrate of bismuth, and boiling the mixture. If sugar be present, the bismuth becomes gray or black.

Krause and Luton's Test.—Boil the urine with bichromate of potash and sulphuric acid, when, if the mixture becomes green or bluish-green, sugar is present.

Maumene's Test consists in steeping strips of woollen stuff in a solution of perchloride of iron, and drying them in a water-bath. If a drop of urine be put in one of these prepared strips, and heated over a spirit-lamp, a black spot forms if the urine contain sugar.

Mulder's Test.—A solution of indigo-carmine, rendered alkaline by carbonate of soda, is allowed to fall drop by drop into the urine, heated over a lamp. This solution gives a color to the urine which is at first blue, but, if sugar be present, becomes green, reddish-purple, reddish-violet, and lastly yellow.

Quantitative Estimation of Sugar.—The specific gravity of the urine affords an indication of the amount of sugar it contains, but this indication is by no means exact, for the specific gravity merely indicates the quantity of solids in the urine, and not of sugar only; and as the urea in diabetes may be, and often is, greatly increased, it is evident that no reliance can be placed on the indications of the urinometer.

Therefore, as the specific gravity alone does not furnish a reliable indication of the quantity of sugar, it has been proposed to destroy the sugar by fermentation, and then calculate the proportion of sugar from the difference between the specific gravity before and after fermentation. Every degree of specific gravity has been shown by Roberts to correspond to about one grain of sugar per fluidounce. Thus, if the specific gravity of the urine be 10·40 before fermentation and 10·20 afterwards, the sugar would amount to twenty grains per ounce.[1] The method consists in putting four ounces of the urine into a twelve-ounce bottle with a lump of German yeast about the size of a walnut, and stopping it with a cork, in which a nick has been cut to allow the carbonic acid to escape. A tightly-corked four-ounce bottle is filled with the same urine, but without any yeast, and both

[1] It is still better to keep the copper and alkaline tartrate separate, and only mix them when wanted, because, according to Dr. Gowers, Fehling's solution which has been made for some time will sometimes give a precipitate of oxide when boiled with healthy urine, although it will not when boiled with water. The solutions for this purpose may be made by dissolving the cupric sulphate alone in one litre of water and diluting the alkaline solution also to a litre. Another formula used by Mr. Martindale is 90½ grains of cupric sulphate dissolved in three fluidounces of water for the cupric solution; for the alkaline solution 180 grains of caustic soda and 364 grains of tartrate of potash dissolved in three fluidounces of water. When these solutions are mixed, they are equal to six ounces of ordinary Fehling's solution.

[1] According to Manassein the percentage amount of sugar is most readily got by multiplying the difference in specific gravity by 1000 and dividing by 456. Thus in the case just given $\frac{20 \times 1000}{456} = 4{\cdot}3$ per cent.

are then placed on the mantelpiece, or in some other warm place. The best temperature is 68° to 75° F., and it should be equably maintained. In about eighteen to twenty-four hours fermentation will be completed, the yeast deposits, the fluid clears, and is found on testing free from sugar. The specific gravity of the two urines may then be taken and compared. This process can easily be carried out by the patient. Another method is to ascertain the amount of carbonic acid generated from the sugar, but this is not a method of much practical use.

Fehling's Method.—The *rationale* of this method has already been described under the head of qualitative analysis of sugar. Its quantitative application depends on the fact that one atom of pure grape sugar = 180 is capable of reducing exactly five atoms = 397 of cupric oxide (CuO) to cuprous oxide (Cu_2O). If we know, then, how much oxide is reduced by a given quantity of urine, it is easy to estimate the amount of sugar it contains. This may be done by adding a solution of copper of known strength, drop by drop, to a measured quantity of urine, until reduction ceases, but in practice it is found more convenient to add the urine gradually to a known quantity of copper solution, boiling it after each addition until the whole of the blue color is discharged. For the details of this process the reader is referred to special works on the analysis of urine.

Estimation by Polarization.—The polariscope consists essentially of two Nicol's prisms, placed at a short distance from each other, one being fixed and the other being capable of rotation. When the axes of the prisms are parallel the light passes through freely, but when their axes are at right angles to each other they stop the passage of the light. If the plane of the ray polarized by the first prism is made to pass through a solution having the power of rotating it to the right or left while on its way to the second prism, the latter will no longer entirely cut off the light when placed at right angles with the first, and in order to stop the light it must be rotated to a greater or less extent according to the deflection which the ray has undergone during its passage through the fluid. When the second prism is attached to a scale, the angle of rotation is readily ascertained.[1]

[1] It is in this way that the instruments of Mitscherlich and Wild are made, but the most exact polariscope is that of Soleil and Ventzke, which is more complicated. In the latter, the rotation effected by a fluid is not ascertained by the lightness or darkness of the field of vision, but by the correspondence in color of its two sides; and the rotation is ascertained, not by rotating a prism, but by turning a screw, which causes the two halves of a quartz compensator to slide upon one another.

PATHOLOGY.—The presence of sugar in the urine as an abnormal constituent has been long known; but the pathological processes which it indicates are only now, thanks to the labors of Bernard, Cyon, Eckhard, Flint, Lusk, Pavy, and others, beginning to be clearly understood. Even yet we generally find diabetes ranged in text-books with albuminuria and other diseases of the kidneys, although we now know that these organs are not at all in fault, but merely separate from the blood the excess of sugar present in it. The blood always contains more or less sugar;[1] but unless it amount to more than about one-third per cent.[2] it is not separated by the kidneys. Its appearance in the urine, therefore, indicates that an excessive quantity of it is present in the blood; and, if we can find out how this excess came to be there, we shall have discovered the pathology of glycosuria. An analysis of blood from the crural or jugular veins, and from the femoral and carotid arteries, shows that less sugar is contained in the venous than in the arterial blood; and therefore destruction of sugar must go on somewhere in the organism.[3] Excess of sugar in the blood may thus be due to two causes—(1) to increased introduction of sugar; or, (2) to diminished destruction of it; or to both of these together.

We will first consider the ways in which an excess of sugar may be introduced into the blood; and this involves the question, How does sugar come to be present in it at all? The ultimate source of the sugar and of every other constituent of the body is, of course, the food we eat; and this, as we may easily see in a typical meal of beef-steak, bread, and pudding, consists of fat, albumen, starch, and cane-sugar. The fat takes no part in the production of sugar within the organism, but the other three do. After they have entered the intestinal canal, the starch is converted into grape-sugar by the saliva and pancreatic juice, and the cane-sugar into a mixture of glucose and levulose by the intestinal juice. The albumen is converted into peptones by the gastric and pancreatic juices. The sugar and peptones

[1] Bernard, Revue Scientifique, 2d ser., tome iv. p. 1023. (Several of these lectures of Claude Bernard have been reproduced in the London Medical Record, 1873, and are well worthy of perusal, both for their matter and as admirable examples of method in experiment and clearness in diction.)

[2] Bernard, Physiologie Experimentale, tome i. p. 302.

[3] Chauveau, Bull. de l'Acad. xxi. p. 1110, Sept. 1856. Harley, Brit. and For. Med.-Chir. Rev. xxxix. July, 1857. Bernard, Revue Scientifique, 2d ser. tome iv. p. 1022.

thus formed in the intestinal canal are absorbed by the intestinal veins,[1] but they are not all at once poured into the general circulation and carried to the brain and muscles. If this were the case, these structures would get all their nutriment at once, and they would have to stow it away themselves for use during the intervals of fasting. Possibly the reserve stores they would thus require to accumulate might clog their action; and, unless they could assimilate all the sugar at once, some of it would pass out in the urine, and thus be lost. It seems, at any rate, that such intermittent nutrition is not good for them, since a means of equalizing it has been provided in the liver. This organ acts as a storehouse, in which the superfluous nutriment absorbed during digestion is laid up, and gradually given out again into the blood during fasting.

Glycogenetic Function of the Liver.—The sugar which has been absorbed from the intestines is conveyed by the portal vein to the liver; and there it is converted into glycogen, and stored up in the hepatic cells. How the transformation is effected we do not at present know; nor can we say whether the sugar is simply transformed into glycogen, or whether it splits up in some peculiar way so as to yield glycogen and fat. That glycogen is formed from sugar, and that sugar is stopped by the liver on its way from the intestine to the general circulation, are shown by several facts. In a starved animal, glycogen disappears entirely from the liver; but it quickly reappears if some sugar be injected into the stomach.[2] It is greatly diminished by fasting, and greatly increased by a full meal. When sugar is injected into the crural vein, it appears in large quantities in the urine: but when it is injected slowly into the portal vein, it is taken up by the liver, and not a trace of it is to be found in the urine. If the injection have been made too quickly, so that the liver cannot transform the sugar as rapidly as it is supplied, a portion of it passes into the general circulation and appears in the urine.[3] If the portal vein be ligatured, so that the blood finds its way from the intestines to the heart and body by means of the collateral circulation without passing through the liver, glycosuria occurs.[4] It would seem that it is only while sugar is being absorbed from the intestines that much of it is present in the portal blood, for generally there is less of it in the portal vein than of almost any other vessel in the body.[1] From the power of the liver to use up sugar in this way, Tscherinow has proposed to call its function glycophthiric, or sugar-destroying. Peptones also form glycogen, for the liver of a dog always yields a much greater quantity of this substance after the animal has had a meal of flesh than when it is fasting. Fick has advanced the hypothesis that the peptones which result from the digestion of albuminous food in the stomach are not again built up into albuminous substances in the organism, as is usually supposed. Instead of this, they undergo further decomposition, and split up into non-nitrogenous and nitrogenous bodies. The non-nitrogenous products are stored up in the body, and serve it as fuel; while the nitrogenous ones are excreted in the form of urea.[2] The urea is probably not formed directly from peptones; for, when they are injected into the blood, the urea is not increased till four or five hours after the injection; and, when meat is digested in the stomach, the increase of urea begins five or six hours after the meal.[3] It is probable, from Schultzen's researches,[4] that glycocine, leucine, and tyrosine are first formed, and that these afterwards become converted into urea. Fick does not say where he supposes the decomposition of peptones to take place; but I think we are not far wrong in saying that it probably does so in the liver and muscles.

We may thus broadly say that albuminous food forms peptones in the stomach and intestines; and these are split up in the liver and muscles, so as to yield glycogen, a non-nitrogenous product, which is stored up in these organs, and urea which is excreted. This at once enables us to understand how it is that, in diabetic patients fed on animal food, the urea and sugar in the urine increase *pari passu*;[5] the sugar in them being in great part excreted with the urea, instead of being stored up as in the healthy body.

[1] Von Mering, Archiv Anat. u. Physiol. 1877, p. 379.

[2] Tscherinow, Wiener Acad. Sitzber. Math.-Naturwiss. vol. li. Abth. 2.

[3] Schöpffer, Archiv. für Exper. Pathologie und Pharmacologie, vol. i. p. 71.

[4] Bernard, Revue Scientifique, 2d serie, tome iv. p. 1066. Compare also the analysis (Revue Scientif. tome iv. pp. 1108 and 1023); also Schiff, Untersuchungen über Zuckerbildung, 1859, p. 3.

[1] Kühne, Lehrbuch der physiologischen Chemie, p. 65. It is difficult to understand the conflicting statements of different observers on this point, except by supposing that their experiments were made on animals in different stages of digestion or fasting.

[2] Fick, Pflüger's Archiv, vol. iv. p. 40; also Rabuteau, L'Union Médicale, 1873, No. 107.

[3] Fick, Verhandlungen der physikal.-medicin. Gesellschaft zu Würzburg, new series, vol. ii. p. 53.

[4] Schultzen and Nencki, Zeitschrift für Biologie, vol. viii. p. 124.

[5] Ringer, Medico-Chirurgical Transactions, vol. xliii. p. 323.

The first great function of the liver, then, is to form glycogen from the sugar and peptones supplied to it from the intestines, and to store them up till wanted. This is termed by Bernard its glycogenetic function.[1]

As the materials on which the liver acts are supplied to it by the *portal vein*, we may connect the *formation* of glycogen with this vessel; while, as I shall afterwards show, the *hepatic artery* is more closely related to its *destruction;* although from the free anastomosis between them, neither vessel possesses any function exclusively. The portal vein in man has the power of contracting very considerably;[2] but the source of its vaso-motor nervous supply is not so well ascertained as that of the hepatic artery. We shall, however, return to this subject in another part of this article.

Diabetes from Deficient Conversion of Sugar into Glycogen.—We can at once see that, if the glycogenetic function be imperfectly performed, too much sugar will pass into the general circulation, and be excreted by the kidneys. It will only do this, however, during the time that the sugar produced by the digestion of starchy or saccharine food is being absorbed from the intestines; and the glycosuria arising from this cause will be intermittent, coming on after meals, and disappearing during fasting,[3] or when sugar and starch are excluded from the diet, and flesh only is used as food. It is evident that if the meals be taken so frequently that the whole of the sugar obtained from one cannot be excreted before absorption of the next one begins, the glycosuria will be remittent instead of intermittent. The sugar will be most abundant when digestion is at its height, and scantier when it is nearly finished; but it will never be entirely absent. This kind of glycosuria will be completely arrested by abstinence from farinaceous or saccharine articles of diet. According to Pavy, it is not uncommon among elderly people; and, so long as the urine is kept nearly free from sugar by attention to diet, it does not appear to injure their health.[4] This kind of glycosuria can be produced artificially in animals by ligature of the portal vein. If this vessel be occluded all at once the animal dies immediately, but if the ligature be tightened around it very gradually, death does not occur. The blood from the intestine then finds its way into the vena cava by way of the collateral circulation instead of passing through the liver; and any substance which may have been absorbed into it from the intestine is therefore carried directly into the general circulation without being exposed to any chance of alteration through the action of the liver upon it. Under such circumstances sugar appears in the urine of dogs which are fed on starchy or saccharine matter during digestion, and is absent while the animals are fasting. The sugar in these cases is found in the urine even when the quantity of starch or sugar given to the animal is small, the glycogenetic function of the liver being completely abolished. The same thing has been noticed by Dr. Colrat, of Lyons, and M. Couturier,[1] in patients suffering from occlusion of the portal vein in consequence of pylephlebitis or cirrhosis. Even in health, the power of the liver to remove sugar from the portal blood and convert it into glycogen is limited; and if it be absorbed too quickly from the intestine, it will pass through the liver and appear in the urine. This occurs when sugar is taken in large quantities by men or by animals, unless it be prevented by some circumstance or other from being too rapidly absorbed.[2] Thus Bernard found that, when he injected a quantity of syrup into the stomach of a dog, sugar appeared in the urine. On repeating the experiment with a rabbit, no glycosuria was induced. The reason of this difference is, that the dog's stomach is generally empty, except immediately after a meal; and the syrup quickly passed into the intestine was altered by the intestinal juice, and was absorbed so rapidly that the liver could not convert it all into glycogen. The rabbit's stomach, on the contrary, always contains a large quantity of vegetable matter, even when the animal has been starved. This mass absorbs the syrup like a sponge, and only allows it to descend slowly into the intestine, so that digestion and absorption go on gradually, and the liver is able to convert all the sugar into glycogen.[3] Bernard shows in a very ingenious manner that the sugar which appears in the urine of the dog is really the same sugar which has been absorbed from the intestine and passed unchanged through the liver, and is not sugar derived from glycogen. The latter consists entirely of dextrose; but that obtained from the urine of the dog contains both dextrose and levulose,

[1] Revue Scientifique, 2d ser. tome iv. p. 1155.

[2] Verhandlungen der physikal.-medicin. Gesellschaft zu Würzburg, 1854, p. 1.

[3] See Traube, Ueber die Gesetze der Zuckerausscheidung im Diabetes Mellitus, Virchow's Archiv, vol. iv. p. 118.

[4] Pavy on Diabetes, second edition, p. 144.

[1] Colrat, Lyon Médical, April 11th, 1875; Dr. Couturier, Thèse de Paris, 1875, No. 209.

[2] Pavy, op. cit. p. 141; and Vogel, in Virchow's Handbuch der speciellen Pathologie und Therapie, vol. vi. Abth. 2, p. 49.

[3] Revue Scientifique, 2d series, tome iv. p. 1066.

which are the ordinary products of the digestion of cane-sugar by the intestinal juice.

The starch and cane-sugar contained in food are not usually converted into grape-sugar by the saliva, pancreatic and intestinal juices, so quickly as to supply sugar to the liver more rapidly than it can convert it into glycogen. An increase in the amount of any of these secretions, such as might be expected to occur in hypertrophy of the pancreas, for example, by leading to more rapid conversion of the food into sugar, might cause diabetes, presenting similar characters to that produced by incomplete glycogenesis in the liver. Almost the only distinction between them would be that, digestion being completed more rapidly in the latter sort, the secretion of saccharine urine would begin sooner after meals and last for a shorter time than in the former. To ascertain this, an examination of the urine would require to be made very frequently; and I am not aware that any observations of this sort are on record. Several cases of glycosuria apparently depending on such alterations in the liver or digestion as have just been described, and arrested by abstinence from starch and sugar, have been recorded by Camplin,[1] Parkes, Traube,[2] Rayer, Bence Jones, and others. In some of these cases, the failure of the liver to perform its glycogenetic function seems to have been the sole cause of diabetes; in them, it could be warded off for many years by abstinence from farinaceous food. In others, the failure of this function seems to have been quickly followed by other changes; and then abstinence from starch failed to prevent the appearance of sugar in the urine, although it had done so at the commencement of the disease. It is possible that another imperfect kind of glycogenesis sometimes occurs when the liver forms glycogen rapidly enough, but of such a kind as to be too readily broken up again. The glycogen obtained from the livers of animals is by no means always of the same quality; for, according to Kühne, some specimens are converted by ferments into sugar with great rapidity, while others are only changed by them after the lapse of hours, although these very specimens may be at once changed into sugar by boiling them with acids.[3]

It is to be observed that the liver is not the only organ in the body which contains glycogen, although it is the chief one. The muscles also contain this substance;[1] and it is found in considerable quantities wherever cell-growth is actively going on, as, for example, in fœtal structures, or in the inflamed parts of the lungs in pneumonia. It is possible that it is first formed in the liver, and is merely carried to these other parts; but as it is readily changed into sugar in the blood, it seems much more likely that muscles and young cells possess also, to some extent, glycogenetic powers, and that the glycogen they contain is actually formed by them from sugar, or peptones supplied to them by the blood. The sugar they receive may either be derived from glycogen in the liver, or directly from intestinal digestion; for it is almost certain that, although a great part of the sugar and peptones is stopped by the liver, the whole of them is not.

Diabetes, from imperfect glycogenesis, then, is to be ascribed chiefly to the liver; but the possible participation of the muscles is to be borne in mind.

Glycosuria during digestion may arise (1) from interference with the portal circulation, so that the blood passes into the vena cava by anastomotic vessels; (2) from imperfect performance of its glycogenetic function by the liver, either in consequence of its tissues being unable for the work they have to do, although the circulation is normal; or of dilatation of the hepatic vessels and too rapid a flow of blood through them; or (3) from the proportion of sugar in the portal blood being rendered too great by the ingestion of a large quantity of sugar into the intestine, by too rapid digestion of amylaceous food, or too rapid absorption from the intestine. It is recognized by the sugar appearing in the urine only during the digestion of starch or sugar, and being absent during fasting, or during the employment of an exclusively meat diet.

Glycogenic Functions of the Liver.—The second great function of the liver is to give out, during fasting, the nutriment which it has stored up during digestion. Although Pavy calls the glycogenic function of the liver a post-mortem phenomenon, it appears so quickly after death that the most rapid manipulation is required to prevent the appearance of sugar. It is very difficult to believe that the liver should in this respect die so quickly when we know that it will in another retain its vitality so long, and will go on secreting bile for two hours after its removal from the body, provided a current of blood be kept up artificially in its vessels.[2] There

[1] Camplin on Diabetes; and Medico-Chirurgical Trans. vol. xxxviii. p. 69; also other cases quoted by Parkes in his work on Urine, p. 317.

[2] Traube, Virchow's Archiv, vol. iv.

[3] Kühne, Lehrbuch der physiologischen Chemie, p. 63.

[1] Bernard, Kühne, and M'Donnell; Kühne's Lehrbuch der physiologischen Chemie, p. 307; Nasse, Pflüger's Archiv, vol. ii. p. 97.

[2] Ludwig and Schmulewisch, Ludwig's Arbeiten, 1868, p. 113.

can be no doubt of the correctness of Pavy's observations, which have done much to increase our knowledge of this subject; but they do not overturn Bernard's theory of the functions of the liver, which may still be accepted as substantially correct. It is to Bernard also that we are chiefly indebted for our knowledge of the influence of the nervous system over the production of sugar by the liver. He had succeeded in stimulating the salivary glands to secrete saliva by irritating the roots of the fifth pair of nerves, and thinking to stimulate the liver in like manner to produce sugar by irritating the vagi, he punctured their roots in the fourth ventricle. As he expected, he produced glycosuria, but on cutting the trunks of the vagi and galvanizing the peripheral parts, he caused no alteration in the production of sugar; but on irritating their central ends he greatly increased the formation of sugar.[1] This showed that the increase was not produced directly through the action of the vagi on the liver, but was a reflex phenomenon. The way in which it produced glycosuria seemed to be by dilating the vessels, and thus increasing the circulation through the liver.[2] The channels by which the nervous stimulus is conveyed to the liver have been determined by Bernard, Schiff, Eckhard, Pavy, and more exactly by Cyon and Aladoff.

The destruction of sugar which Bernard supposed to occur in the lungs was shown by Chauveau and Harley[3] to take place in the systemic capillaries; and the researches of Ludwig and his pupils, as well as of Schultzen and others, have done much to indicate the tissues where it is chiefly consumed and the exact method of its decomposition.

We may say that the nutriment stored up in the liver is again distributed by the glycogen, which has been stored up in the organ, becoming gradually transformed into sugar again. It is then washed out of the liver by the blood and carried with it into the general circulation. The conversion of glycogen into sugar is effected by means of a diastatic ferment, of which a minute quantity only is present in the liver itself, but which is contained to a much larger amount in the blood. When the flow of blood through the liver is slow, the transformation of glycogen goes on gradually, but it is quickened whenever the current becomes more rapid. It seems probable that, although the blood of the portal vein may have something to do with the transformation of glycogen into sugar, this process is more closely connected with the circulation through the hepatic artery; for those lesions of the nervous system which increase the flow of blood through the liver and induce diabetes, have, according to Cyon,[1] little influence over the calibre of the vein, but cause the artery to dilate widely. As the blood from the artery flows into the portal vein, any increase in the circulation within it also quickens that in the vein to some extent. The circulation in the liver may be increased either by raising the pressure of blood in the arteries generally, so that the blood flows more quickly through the hepatic artery, although its size may remain the same as before, or by causing it to dilate, so that it receives a greater share of blood, while the pressure in the arteries generally remains the same.

The pressure of blood in the arteries generally may be raised by compressing any large artery, by violent muscular efforts, or by interference with respiration. The operation of these causes is followed by a greater production of sugar in the liver, its increase in the blood of the vena cava, and even its appearance in the urine. Schiff was able to produce diabetes by ligaturing large vessels, and Pavy[2] found in his experiments that whenever an animal struggled either on account of discomfort or because its respiration was interfered with, the quantity of sugar in the blood of the vena cava and carotids was at once increased. According to Michea and Reynoso,[3] it appears temporarily in the urine after an epileptic or convulsive hysterical fit. This power of muscular action to increase the proportion of sugar in the blood is exceedingly interesting, for sugar is destroyed in the muscles during their contraction, and is in all probability to be regarded as at least a part of the fuel from which they derive their energy.[4] The action of muscles, which causes the destruction of sugar within them, at the same time leads to an additional supply being furnished to them, and thus the balance of waste and supply is properly sustained.[5] The occurrence of sugar in

[1] Bernard, Leçons sur le Diabète, p. 370, and Physiologie Expérimentale, tome i. p. 316.

[2] Bernard, Physiologie Expérimentale, tome i. p. 334.

[3] Chauveau, Bull. de l'Acad. xxi. p. 1110; Harley, Brit. and For. Med.-Chir. Rev. xxxix. July, 1857.

[1] Cyon and Aladoff. Reprint from the Mélanges Biologiques (which Professor Cyon was kind enough to send to me); and Bulletin de l'Académie Imperiale de Petersbourg, vol. viii. p. 91.

[2] Pavy, On Diabetes, pp. 62, 68, and 145.

[3] Trousseau, Clinique Médicale, ed. 2me, tome ii. p. 665.

[4] Ludwig and Genersich, Arbeiten aus der physiologischen Anstalt zu Leipzig, 1871, p. 75.

[5] Ludwig and his pupils, *vide* Ludwig's Arbeiten, 1876, p. 45.

the urine of persons suffering from cholera, or who have died from exposure to cold, is probably also to be attributed, at least in part, to the contraction of the blood vessels near the surface of the body increasing the circulation in the liver. The intermittent glycosuria which has been observed to be present during or after a fit or ague, and absent during the interval, may also be ascribed to the rise in the general blood-pressure which occurs during the paroxysm.

Dilatation of the hepatic vessels, and increased flow of blood through them, may be produced by paralyzing their vaso-motor nerves either directly or reflexly. The vaso-motor centre (*a*, 85) is situated

Fig. 85.

Diagram showing the course of the vaso-motor nerves of the liver, according to Cyon and Aladoff. These nerves are indicated by the dotted line which accompanies them: *a*, vaso-motor centre; *b*, trunk of the vagus; *c*, passage of the hepatic vaso-motor nerves from the cord along the vertebral artery; *d*, fibres going on each side of the subclavian artery, and forming the annulus of Vieussens; *e*, first dorsal ganglion; *f*, gangliated cord of the sympathetic; *g*, the spinal cord; *h*, splanchnic nerves; *i*, cœliac ganglion, from which vaso-motor fibres pass to the hepatic and intestinal vessels; *k*, the lungs, to which fibres of the vagus are seen to be distributed; *l*, the liver; *m*, the intestine; *n*, the arch of the aorta.

in the medulla oblongata. From it proceed those constant stimuli to all the vessels in the body by which their state of moderate contraction, or tone, as it is often termed, is maintained. The vaso-motor nerves for the hepatic vessels, indicated in the figures by the dotted line which accompanies them, pass from the vaso-motor centre down the spinal cord for a certain distance, then proceed through some of the communicating branches to the sympathetic cord and through the splanchnic nerves to the liver. The point at which they leave the spinal cord and pass to the sympathetic is not quite certain. According to Cyon and Aladoff[1] they leave the cord by means of the fibres (*c*) which accompany the vertebral artery, passing in them to the lower cervical ganglia. Thence they proceed in two fibres (*d*), one of which passes on either side of the subclavian artery, forming the annulus of Vieussens to the first dorsal ganglion (*e*), and thence through the gangliated cord of the sympathetic (*f*) and the splanchnics (*h*), to the cœliac ganglion (*i*), and along the hepatic vessels to the liver.

The first way in which dilatation of the hepatic vessels may be caused is by direct paralysis of the vaso-motor nerves for the liver. This may be produced by dividing these nerves at any point between the medulla and the liver. The influence of the vaso-motor centre will then be removed, and the hepatic vessels will dilate. Unless other circumstances should interfere, the flow of blood through the liver will be accelerated, and the production of sugar increased. Diebetes arising from division of the nerves is generally supposed to be permanent. In this it differs from diabetes induced reflexly by irritation of nerves, which ceases shortly after the irritation has passed off. This distinction is applied to that produced by operations; for, of course, permanent diabetes may depend on permanent irritation, and this is probably frequently the case where the disease occurs in man. Schiff[2] found that diabetes could be produced by division of the anterior columns of the spinal cord between the medulla and the fourth cervical vertebra. This lasted for days or weeks, in fact, till the animal died. Cyon and Aladoff have also observed diabetes which they attributed to paralysis of the vaso-motor nerves of the liver, after section of the fibres which accompany the vertebral artery, of the last cervical or first dorsal ganglion, or of the fibres forming the annulus of Vieussens. Eckhard has not succeeded in confirming their results,[3] and it is therefore by no means improbable that the vaso-motor nerves of the liver do not always leave the spinal cord to join the sympathetic by the fibres accompanying the vertebral artery, but sometimes pass further down the spinal

[1] Cyon and Aladoff, op. cit.

[2] Schiff, Untersuchungen über Zuckerbildung in der Leber, 1859, p. 108.

[3] Eckhard, Beiträge, vol. vii. 1873, p. 19.

cord, and leave it by the communicating branches going to some of the dorsal ganglia. This is all the more probable, as we have an instance of a similar kind in the case of the cardiac nerves.[1] As the vaso-motor nerves of the liver pass along the gangliated cord and the splanchnics, one would expect that section of these structures would produce diabetes. But this is not the case, for the sympathetic cord may be divided between the tenth and twelfth ribs, or the splanchnics may be cut, without sugar appearing in the urine. On the contrary, when other means, such as puncture of the fourth ventricle, have been employed to induce it, no sugar appears in the urine if these nerves have been previously cut. At first sight, this result is very perplexing; but Cyon has most ingeniously explained it, by reminding us that it is not mere dilatation of the hepatic vessels, but increased circulation through them, which accelerates the formation of sugar; and the width of the vessels is of little consequence if there be not sufficient blood to fill them. Now, the vessels of the intestine, especially when the digestive canal is long as it is in rabbits, are so capacious, that when dilated they can hold as much blood as all the rest of the vascular system put together, and their vaso-motor nerves are also contained in the lower part of the cord and in the splanchnics. Consequently, when these are divided, the vaso-motor nerves of the intestinal vessels become paralyzed as well as the hepatic ones, the vessels themselves dilate and retain so much blood that there is not enough left to increase the flow of blood through the liver, even though the hepatic vessels may be standing wide open to receive it. But if the vessels of the liver be first dilated, and the cord or splanchnics be then cut, the formation of sugar is not arrested; for a brisk circulation having once become established in the liver, still continues, although the intestinal vessels may become dilated.

A similar explanation may be given of the results obtained by Pavy, in one of his experiments.[2] He isolated the hepatic artery, portal vein, and hepatic duct, and then carefully divided all the remaining structures in the lesser omentum, including therefore the nerves passing to the liver. Notwithstanding that the hepatic nerves had been thus divided, and the splanchnics left uninjured, no sugar appeared in the urine. At first sight, this seems rather extraordinary, but a little reflection will show that the conditions are similar to those in Cyon's experiment. It is almost impossible to divide all the nerves of the liver without irritating the intestines and causing a considerable amount of congestion in them. Dilatation of the vessels produced in this way will have the same effect as division of the splanchnics. While watching a distinguished German physiologist dividing some of the nerves in the mesentery of a dog, I have seen the intestine become greatly congested, and so much blood has gone to it that there was not sufficient circulation in the brain to sustain its activity, and the dog, which was being operated on, slept soundly, although it had received no narcotic.

The second way in which the hepatic vessels may be dilated is by reflex paralysis, or inhibition, as it is generally termed, of their vaso-motor nerves. Every one knows that, when a sensory nerve is irritated, the impression is transmitted to the vaso-motor centre, and arrests its usual action over the vessels of the part to which the sensory nerve is distributed. Thus, when a grain of sand falls into the eye, the irritation which it occasions to the sensory nerves of the conjunctiva is conveyed by them to the vaso-motor centre, and arrests the action of that part of it which regulates the contraction of the conjunctival vessels. In consequence of this, they become dilated and full of blood, and continue so while the irritation continues; but, so soon as it is removed, the vaso-motor centre again regains its wonted power, and the vessels return to their normal size. The same is the case with the liver; and its sensory nerve is the pneumogastric. If this nerve be cut across, and its lower end irritated, no effect on the liver can be noticed; but, if its upper end be stimulated, the vessels of the liver dilate, the circulation increases, and sugar appears in the urine.[1] Irritation of the roots of the pneumogastric, in Bernard's famous experiment of puncture of the fourth ventricle, has the same effect as stimulation of its trunk. This experiment is performed by pushing an instrument like a brad-awl through the skull and cerebellum till it reaches the olivary fasciculi in the medulla oblongata. The instrument is prevented from injuring the anterior motor fibres of the medulla by a needle-like point which projects about the eighth of an inch from the middle of its edge. This is too fine to injure them itself, and, by coming in contact with the occipital bone, it prevents the edge of the awl from going too far. The irritation thus occasioned to the vagus roots inhibits the vaso-motor centre of the liver, and in half an hour, or an hour, sugar appears in the urine. It does not remain more than a few hours,

[1] Schmiedeberg, Ludwig's Arbeiten, vol. vi. p. 34.

[2] Pavy, op. cit. p. 171.

[1] Bernard, Physiologie Expérimentale, tome i. p. 326.

but disappears when the irritation has passed off; and in this it differs much from the diabetes produced by dividing the vaso-motor nerves of the liver. When this is done by cutting the anterior columns of the cord in the neck, sugar, as has been already mentioned, will persist for days or weeks.[1]

Irritation of the peripheral terminations of some branches of the pneumogastrics has a similar effect to one applied to their roots or trunks. These nerves are distributed to the liver, lungs, heart, stomach, intestines, &c., but these filaments do not all seem to have the same power of inducing dilatation of the vessels. Diabetes can be produced by irritating the liver by needles[2] or electrodes[3] placed in it, or by the injection of irritating drugs, such as alcohol, into the portal veins;[4] and irritation in the intestine seems occasionally to have the same effect, for there is a case on record of diabetes caused by the presence of a tapeworm in the intestines, and immediately cured by its removal. The influence of the cardiac, gastric, and other branches, has not been well ascertained. Eckhard has noticed the occurrence of diabetes after operations on the abdominal cavity without any definite lesion of nerves. The pulmonary branches seem to have a most important action, as the air inhaled during respiration appears to supply them with a constant stimulus, and thus continuously inhibits, to a certain extent, the vaso-motor nerves of the liver. When the pneumogastrics are cut across, this influence is of course removed, the hepatic vessels contract, and the production of sugar diminishes.

Increased respiration, on the other hand, seems to have the effect of increasing the formation of sugar; for Tieffenbach[5] observed that artifical respiration, performed by blowing air into the lungs by means of bellows, sometimes produced glycosuria. The appearance of sugar in the urine of animals poisoned by woorara is probably due partly to the artificial respiration employed to keep the animal alive, as well as to the action of the poison on the muscles, which will be considered afterwards. This is all the more probable because, when respiration is kept up to allow the animal to recover from the effects of woorara, sugar makes its appearance. The fact that it does not do so while the animal is completely paralyzed points to a reflex production of the phenomenon; for Schiff[1] has found that large doses of woorara paralyze the sensory as well as the motor nerves; and, as this loss of sensibility will destroy reflex inhibition, it is sufficient to explain the non-occurrence of reflex dilatation of the hepatic vessels while much woorara is present in the system. He states also that, when the respiration is effected gently, and the canula is not tied into the trachea, but only laid loosely in it, so that the lungs are not over-distended by the force of the bellows, diabetes is not produced.[2] When the nerve-centres are very deeply narcotized, as when an animal is thoroughly under the influence of ether, even puncture of the fourth ventricle will not cause diabetes;[3] and Pavy[4] found no sugar in the urine of animals when he extirpated the superior cervical ganglion under the influence of chloroform, although it appeared when he narcotized the animals with the fumes of puff-ball, which, though it stupefied them, would probably not affect the vaso-motor centre through which the irritation of the operation would influence the hepatic nerves.

The glycosuria which is often observed after inhalation of carbonic oxide,[5] ether, and chloroform, may also be ascribed to irritation of the pulmonary branches of the vagus by these drugs before anæsthesia has become complete. If narcosis be quickly produced, sugar is not unfrequently absent; but it generally appears if narcosis be induced slowly, so that the irritant vapor acts long on the lungs, while the vaso-motor centre is yet unaffected by it. The glycosuria is not due to the struggles of the animal during the administration of the anæsthetic: for Schiff found it in a hedgehog which only succumbed to the influence of the anæsthetic after a long time, but did not make the slightest movement during the whole time.[6] The beneficial effect of opium and codeia in diabetes is probably due in part to their lessening reflex inhibition in the liver, as opium most assuredly does in

[1] Schiff, Untersuchungen über Zuckerbildung in der Leber, 1859, p. 108.
[2] Schiff, op. cit. p. 106.
[3] Pavy, op. cit. p. 137.
[4] G. Harley, British and Foreign Quarterly Review, July, 1857.
[5] Tieffenbach, Inaugural Dissertation: Königsberg, 1869. Abstracted in Centralblatt für die medicinischen Wissenschaften, 1869 p. 179.

[1] I am uncertain where this is published. Schiff himself informed me verbally of his discovery, and I have repeated his experiments with similar results.
[2] Schiff, Journal de l'Anatomie et de la Physiologie, 1866.
[3] Schiff, Untersuchungen über Zuckerbildung, p. 10.
[4] Pavy, On Diabetes.
[5] Schiff, Untersuchungen über Zuckerbildung, p. 124.
[6] Senff, Inaugural Dissertation, Dorpat, 1869; Henle und Meissner's Jahresbericht, 1869, p. 173.

the case of some other glands,[1] and thus diminishing the production of sugar. It seems probable also that reflex inhibition may follow irritation of other parts of the encephalon, and possibly also of sympathetic ganglia, as well as of the roots, trunks, and branches of cerebro-spinal nerves.

The diabetes which has been observed after injuries of the cerebral lobes in man, of the cerebellum in animals by Eckhard,[2] of the superior cervical ganglion by Pavy, of the optic thalami, cerebral peduncles, pons Varolii, middle peduncles of the cerebellum, and of the cervical sympathetic cord and sciatic nerve by Schiff,[3] is probably due to this cause, as in all these cases it is only temporary, and not permanent. Irritation of the sciatic nerve in man seems to have the same effect as in animals, for temporary diabetes has been observed during an attack of sciatica.

There is another possible cause of increased formation of sugar in the liver; and that is, a greater proportion of diastatic ferment in it or in the blood which flows through it. The quantity of ferment in the liver of animals varies, and it is sometimes absent altogether. The same is probably the case with the blood. We do not know whether this ferment is peculiar to the blood, or whether it is ptyalin or pancreatic ferment absorbed from the intestines. Tiegel,[4] indeed, states that it differs from pancreatic ferment in being insoluble in glycerine; but von Wittich has obtained a diastatic ferment from the liver by glycerine, and I have done the same. It is possible that there may be two ferments having a similar action. Pepsin seems to be absorbed from the stomach, for it has been found in the muscles and even in the urine by Brücke; and pancreatic ferment seems also to be absorbed, for Hüfner found a ferment, possessing like it the properties of converting starch into sugar and of digesting fibrine, in the salivary glands and lungs. The increased secretion of a hypertrophied pancreas, which Niemeyer asserts to be common in diabetes, may thus not only act by quickening the conversion of starch into sugar in the intestines, but by increasing the transformation of glycogen after its absorption into the blood. But atrophy of the pancreas is quite as common a lesion in diabetes as hypertrophy; and if we suppose, as is usually done, that the only function of the pancreas is that of forming ferment, it is difficult to explain the occurrence of diabetes under these conditions, except on the supposition that in both of them the nerves of the organ are irritated, and cause reflex dilatation of the vessels of the liver in the same way that irritation of the liver itself does. But, if we suppose that the pancreas not only forms ferment, but also excretes ferment already circulating in the blood, in much the same way as the liver both forms and excretes bile, we at once see that the diastatic ferment which Hüfner supposes to be found in many parts of the body may accumulate in the blood because the pancreas can no longer excrete it, and thus lead to diabetes; for both bile and pancreatic juice can only be partially absorbed in the normal condition; another part will be evacuated with the feces. I apprehend, however, that this explanation will seem to many persons to be too hypothetical, and that irritation of the pancreatic nerves and reflex dilatation of the hepatic vessels will appear a more probable cause of diabetes in cases of diseased pancreas. Plosz and Tiegel[1] have found that the ferment is contained in the blood-corpuscles alone, and not in the serum. When the blood-corpuscles are destroyed, the ferment acts vigorously,[2] as it is then set free. The diabetes observed by Harley after the injection of ether into the portal vein is probably due to the blood-corpuscles being dissolved by the ether.

I have already mentioned that the muscles contain glycogen, and, during their action, sugar is actually formed in them. The possibility of changes similar to those in the liver occurring in them must be borne in mind as a possible factor in diabetes.

Diminished Combustion of Sugar in the Body.—Having considered the effect of increased formation of sugar, we must now look at diminished combustion of it as a cause of diabetes.

The healthy organism is able to consume not only all the sugar produced within itself, but even more; and, if a solution of glucose or glycogen be injected in small quantities under the skin or even into the veins of an animal, no sugar will appear in the urine. This destruction of

[1] In experiments upon the secretion of saliva I have found that in an animal deeply narcotized by means of opium, neither irritation of the lingual nerve nor chorda tympani causes the same marked dilatation of the vessels of the submaxillary gland which Bernard describes as occurring in animals which have not been narcotized.

[2] Eckhard, Pester medicin.-chirurgische Presse, No. 7, 1873, p. 98; and Hulz, Beiträge über Hydrurie und Melliturie, Marburg, 1872.

[3] Schiff, Journal de l'Anatomie et de la Physiologie, 1866, p. 376; and Untersuchungen über Zuckerbildung, p. 114.

[4] Tiegel, Pflüger's Archiv, vol. vi. p. 249.

[1] Pflüger's Archiv, 1873, vol. vii. p. 391.

[2] Tiegel, Pflüger's Archiv, vol. vi. p. 249.

[3] Tieffenbach, op. cit.

sugar probably goes on chiefly in the blood, lungs, and muscles, though it may take place in other tissues as well. Its occurrence in blood after it has been drawn is shown by the sugar contained in it disappearing after a short time when it is kept at a moderate temperature; and there is no reason to suppose that this does not go on within the body, more especially as Binz[1] and Zuntz have shown that the formation of acid, which goes hand in hand with the destruction of sugar, occurs even more quickly while the blood is still fluid, or, as we may say, alive, than after coagulation has taken place. The important part played by the lungs in the destructive process is evident from the great diminution which the sugar sometimes undergoes during its passage from the right side of the heart to the carotid artery; and the powers of muscle in this respect are shown by the observation of Ludwig and Genersich,[2] as well as of Bernard,[3] that the blood which passes through the vessels of a contracting muscle contains much less sugar when it issues from the vein than when it enters the artery. And yet, strangely enough, Ludwig and Scheremetjewski[4] found that, after grape-sugar had been injected into the veins of an animal, little or no increase took place in the oxygen consumed or the carbonic acid given off from the lungs—a result which indicates that grape-sugar, *as such*, is not burnt off in the body. On the other hand, however, they found that, when lactic acid as well as other organic acids, combined with soda, were injected into the veins, the amount both of oxygen and carbonic acid rose greatly, showing that these acids underwent combustion with great facility. Glycerine also undergoes combustion readily. Now, Bernard finds that, as the sugar disappears from the blood, its place is taken by lactic acid;[5] and as Du Bois-Reymond has shown, an accumulation of sarcolactic acid in muscles occurs after they have been kept in action.[6] Muscles after death acquire an acid reaction by the formation within them of lactic acid from sugar or glycogen which they contain;[7] and when added to a solution of grape-sugar they will cause the formation of acid in it also. That this conversion of sugar into lactic acid is due to a ferment, is shown by the close correspondence between it and other processes of fermentation.[1] Thus, if the blood be heated so as to destroy the ferment, the sugar will remain unchanged;[2] and Binz and his scholars have shown that quinine and other substances, which lessen fermentation, likewise diminish the production of acid in blood. Bernard has also demonstrated that blood, like other ferments, acts more rapidly on glucose than levulose: whereas alkalies, to which the destruction of the sugar in the blood was long attributed, act more rapidly on the latter kind of sugar than on the former.

The interesting experiments of Schultzen show more clearly than any others how sugar is decomposed in the body. A year or two ago, he found that, in animals poisoned by phosphorus, the processes of oxidation are arrested in the organism, but those of decomposition by ferments go on.[3] In such animals, urea disappears from the urine, and is replaced by leucine and tyrosine, which in the healthy organism are converted into urea.[4] No sugar appears in the urine, but a kind of lactic acid is found in quantities exactly proportional to the amount of sugar afforded to the animals by their food. This kind of lactic acid agrees exactly in its properties with the aldehyde of glycerine, and Schultzen considers the two bodies to be identical.[5] He thinks that, in the normal condition, sugar is split up by the action of a ferment into this glycerin-aldehyde and glycerine in the manner indicated in the following formula: Glucose $C_6H_{12}O_6$ + Hydrogen H_2 = Glycerin-aldehyde $C_3H_6O_3$ + Glycerine $C_3H_8O_3$. When the ferment is absent, as he supposes it to be in some cases of diabetes, the sugar is not split up, and so does not undergo combustion, but is excreted in the urine. In diabetics, the processes of oxidation are not impeded; for the nitrogenous waste products appear in the urine as urea, and not as leucine, as they do when oxidation is impaired in phosphorus-poisoning. The imperfect combustion of the sugar is due, he considers, to the want of ferment which should prepare it for oxidation, and not to the want of oxygen.

In view of these facts, we are, I think,

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[1] Archiv für experimentelle Pathologie und Pharmacologie, vol. i. p. 20.

[2] Ludwig's Arbeiten, 1871, p. 75.

[3] Bernard, Revue Scientifique, 2d series, tome iv. p. 1022.

[4] Ludwig's Arbeiten, 1869, pp. 144 and 141.

[5] Bernard, Revue Scientifique, 2d series, tome iv. p. 1159.

[6] Du Bois-Reymond, Journal für Chemie, 1859, vol. lxxvii. p. 233.

[7] Bernard, op. cit. p. 1159.

[1] Some time ago I tried to separate this ferment from muscles by von Wittich's method, by glycerine, but was only partially successful.

[2] Bernard, Leçons au Collége de France. tome i. p. 230.

[3] Schultzen und Riess, Ueber acute Phosphorvergiftung, Separatabdruck aus den Annalen der Charité, Band x.

[4] Schultzen und Nencki, Zeitschrift für Biologie, vol. viii. p. 124.

[5] Schultzen, Berliner Klinische Wochenschrift, 1872, No. 35, p. 417.

justified in believing that the sugar which is present in the blood becomes converted by the aid of a ferment in the blood, muscles, and probably lungs also, into lactic acid and glycerine; and then undergoes combustion, thus sustaining the temperature of the body. Supposing, however, that this ferment is deficient, a greater or less proportion of the sugar will not undergo conversion into acid, and will then remain unconsumed, as in Ludwig and Scheremetjewski's experiment.[1] Unless the combustion of that quantity of sugar which does undergo transformation with the aid of fat, &c., be sufficient to sustain the temperature of the body, it will fall more or less below the normal; and this is actually what we find in a considerable number of diabetic patients. The muscular weakness which is observed in them is just what we should expect from the muscles being unable to make full use of the sugar which ought to supply them with energy for their work, though it is not improbable that excess of sugar in the blood may itself cause muscular fatigue. Whether this be the true explanation of their weakness or not, it is difficult to say; for we do not yet know how it is that chemical action is transformed in muscle into mechanical work; nor are we acquainted with the manner in which oxygen is stored up during the hours of rest in order to be expended during the time devoted to labor. Whenever we do learn this, we shall gain a deeper insight into diabetes; for Pettenkofer and Voit have found that patients afflicted with this disease have not the power, which a healthy man possesses, of absorbing more oxygen during the night than they need at the time, and using it up during the day. They are thus obliged to work as it were from hand to mouth, and are incapable of any great exertion.

The formation of lactic acid depends on the sugar as well as the ferment, and it is quite possible that the former may be in fault as well as the latter. I have already mentioned that different specimens of glycogen are acted upon by ferments with varying degrees of facility; and it would seem to be the same with sugar even when derived from similar sources, for Bernard, when arranging the different sorts according to the ease with which they are destroyed in the body, ranks sugar obtained from the liver above diabetic sugar.[2]

The destruction of sugar probably goes on in the blood, brain, glands, &c., as well as in the muscles, but to a much less extent. In order that the sugar in the blood may be destroyed in the muscles, however, it must pass into them. Now, very little blood circulates through muscles when they are at rest, but the flow is much increased when they become active. More sugar will thus be carried to them and destroyed; but, as I have already mentioned, muscular exertion raises the blood-pressure, and increases the circulation in the liver and the formation of sugar in it, so that the balance is maintained. We can readily see that, if the liver go on producing sugar, and it be not destroyed in the muscles, it will accumulate in the blood, and at last appear in the urine. This, I believe, takes place in animals paralyzed by woorara. Bernard thinks that the glycosuria produced by this poison, and also by large doses of morphia, is not due to their action on the muscles, but is to be ascribed entirely to their causing paralysis of the hepatic vaso-motor nerves and increased formation of sugar in the liver. I believe that woorara does exert this action; but the glycosuria is not due to it alone, but to its effects on the muscles also. My belief is founded on the experiments of Dock;[1] and, to make the grounds of it more intelligible, I shall shortly give the results of his research. 1. When rabbits are starved, glycogen disappears from the liver. 2. In such rabbits, puncture of the fourth ventricle does not produce diabetes. 3. After a few injections of cane-sugar into the stomach of starved rabbits, glycogen reappears in the liver. Injections of water, albumen, or fat, have not this effect. 4. If the fourth ventricle be punctured before the injection, no glycogen appears in the liver, and no sugar is found in the urine. 5. Poisoning by woorara produces diabetes in starved rabbits, although puncture of the fourth ventricle does not. 6. After poisoning by woorara, injections of sugar into the stomach do not produce glycogen in the liver; but sugar is abundantly found in the urine.

I must also mention that Weiss[2] has discovered that a considerable amount of glycogen remains in the muscles of starved animals after it has completely disappeared from the liver; and they retain their muscular activity as long as it is present in the muscles. The explanation of these results is by no means difficult. Indeed, it would have been easy for any believer in Bernard's theory of the causation of diabetes by puncture of the fourth ventricle to foretell that it would not induce glycosuria in animals when their livers contained no glycogen; for, this being absent, no increase in the hepatic

[1] Ludwig and Scheremetjewski, op. cit. p. 145; Schultzen, op. cit.

[2] It is possible that this may be due to the sugar from diabetic urine consisting sometimes of a mixture of sugar derived from the liver and sugar absorbed from the intestine.

[1] Dock, Pflüger's Archiv, vol. v. p. 571.

[2] Weiss, Sitzungsberichte der Wiener Academie, vol. lxiv. p. 284.

circulation could increase the formation of sugar. When the puncture is made and the hepatic vessels are consequently dilated before cane-sugar is injected into the stomach, no glycogen is found in the liver; for it is converted into sugar, and washed away by the blood as soon as it is formed. It does not appear in the urine, for it is used up by the muscles as quickly as it is absorbed from the intestines. When the animals are poisoned by woorara, there is no accumulation of glycogen in the liver, for the poison paralyzes the hepatic vessels, and thus produces the same effect as puncture; but it also prevents the muscles from using up the sugar, which therefore appears in the urine.

The occurrence of sugar in the urine of starved animals after woorara-poisoning must be due to the glycogen in the muscles undergoing conversion into sugar, and its transformation being arrested at this stage, instead of changing into lactic acid and glycerine, and undergoing combustion as it ought to do.

There are some other substances, such as nitrite of amyl,[1] and nitrobenzol,[2] which probably cause diabetes chiefly by arresting the decomposition of sugar, although they may also act on the liver.

Since sugar has to be converted into lactic acid before it is burned off, and it is not improbable that the amount of this conversion is more or less regulated by the demand, we would not unnaturally expect that the injection of easily combustible organic acids into the blood, by preventing the combustion of sugar, might lead to its accumulation in the blood and its appearance in the urine. And such, in fact, is the case. According to Eckhard,[3] sugar appears in the urine of a rabbit after the introduction into its veins of carbonate, acetate, succinate, or valerianate of soda; and G. Goltz[4] noticed it after putting lactic acid into the stomach of the same animal.

To recapitulate shortly what has already been said: The liver has two functions—1, that of taking up the sugar which it receives from the intestines, and converting it into glycogen; and 2, that of forming sugar again from glycogen. The muscles probably possess three functions: 1. They take up sugar from the blood and convert it into glycogen; 2. They form sugar again from this glycogen; 3. They change both the sugar they form and the greatest part of that which they receive from the blood into lactic acid and glycerine, which undergo combustion.

Diabetes may arise—1*st. from increased formation of sugar*, due to (*a*) excessively rapid digestion of starch or sugar; (*b*) to failure or imperfection in the glycogenetic function of the liver, and possibly to some extent also of the muscles; (*c*) to increased transformation of glycogen into sugar, due to accelerated circulation through the liver, or a larger proportion of ferment in the organ or the blood. The circulation may be quickened either by increase of the general arterial pressure or by dilatation of the vessels of the liver, and especially of the hepatic artery. Increased blood-pressure may be due to muscular exertion, such as occurs in epilepsy, or to contraction of the arterioles, such as is caused by impeded respiration, exposure to cold, cholera, and Bright's Disease. The hepatic vessels may be dilated reflexly by irritation applied to the vagus, either at its ends in the lungs, liver, or intestine, in its trunk, or at its roots in the medulla, or to the cerebrum, cerebellum, pons, and probably some of the sympathetic ganglia. They may also be dilated, and the current in them accelerated, by section of their vaso-motor nerves at any point between the medulla and the liver, provided that the intestinal vaso-motor nerves are not also divided, and the supply of blood so much diminished that no increase in the hepatic circulation follows the section. Increased formation may also occur in the muscles.

2*d*. Diabetes may also arise *from lessened combustion*, due either (*a*) to insufficiency of the ferment which should convert the sugar into lactic acid and glycerine; (*b*) to an altered quality of the sugar which enables it to resist the action of the ferment; or (*c*) to diminished circulation through the muscles preventing the sugar from coming sufficiently into contact with the ferment.

Prognosis.—The prognosis of diabetes depends considerably upon age; the younger the patient, the more unfavorable is it. Complete cure is rare, although almost every case can be very greatly benefited by treatment. When the disease occurs in patients under the age of twenty, few, if any, recover; but if it does not come on until middle age the prognosis is much better, and the patient may live for many years, even with little treatment.

The hereditary transmission of the disease adds to the gravity of the prognosis. It is much more serious when the onset is

[1] Gamgee and Rutherford, quoted by Brunton in Sanderson's Handbook for the Physiological Laboratory, p. 515; and Hoffman, Reichert und Du Bois-Reymond's Archiv, 1872, p. 746.

[2] Ewald, Centralblatt der medicinischen Wissenschaften, 1873, p. 819.

[3] Eckhard and Külz, Pesther medico-chirurgische Presse, Feb. 1873, p. 113.

[4] G. Goltz, Centralblatt für die medicinischen Wissenschaften, 1867, p. 705.

acute than when gradual, and when no apparent cause can be assigned than when it follows mechanical injury or mental anxiety. Its gravity also depends upon the amount of sugar passed, and on the relation of this to the digestive powers of the individual. If the quantity of sugar be great the danger to the patient is much increased, and if the digestive powers be insufficient to supply the drain upon the system, emaciation and death necessarily result. The drain is of course less when the quantity of urine is small, for even though it contain a considerable proportion of sugar, the total quantity passed daily is less than when the urine is copious. The absence of diuresis is therefore a favorable sign. When the patient is large, corpulent, and of a gouty diathesis, the disease may exist for a considerable time without producing much apparent effect upon the general health. The prognosis is much more favorable than in thin persons. Indeed, in some corpulent gouty individuals, the appearance of sugar in the urine about middle age would seem to deserve the name of gouty glycosuria rather than of diabetes, as it frequently gives rise to none of the usual symptoms of the disease except slight thirst. The ready disappearance of sugar on abstinence from starchy food is a favorable sign, but if sugar continues to appear when the patient is upon flesh diet, the case is much more serious.

The appearance of cataract is an unfavorable sign, and permanent amblyopia is frequently followed by a fatal termination. Carbuncles or gangrene are also of evil omen.

The appearance of albumen in the urine even when the quantity is slight is of very grave import, and when the appetite fails and diarrhœa sets in, or when the lungs show signs of consolidation or softening, there is little chance of recovery.

Treatment. — The most important item in the treatment of diabetic patients consists in careful attention to the diet. The excessive quantity of sugar, which in this disease is present in the blood, is not merely useless, it is positively injurious; and we must endeavor to reduce it as nearly as possible to the normal by causing the patient to abstain from those articles of food which produce it easily. These are—sugar of every kind, and in every shape; all foods containing starch, such as bread, pastry, puddings, maccaroni, vermicelli, rice, sago, tapioca, arrowroot, potatoes, beans, peas, carrots, parsnips, and turnips, as well as the softer and whiter parts of such vegetables as cabbage, Brussels sprouts, broccoli, cauliflower, asparagus, seakale. The patient must abstain from liver on account of the glycogen it contains, and must drink sparingly, even of milk, as milk sugar can be converted into a form of glucose. Sweet and sparking wines, and sweet ales, porter, stout, cider, liqueurs, should be avoided, and port wine only sparingly used. The diet may consist of any kind of flesh, whether of bird, beast, or fish, and whether fresh, dried, salted, smoked, or cured. Extracts of meat and gelatine may be taken in the form of soup, of meat extract, or of jellies. Eggs may be employed in any form, and so may fat, whether alone, as oil, butter, or mixed with albuminous matter, as in cream or cheese. Almonds and nuts of every kind, except chestnuts, may be freely indulged in. They contain much oil, and are very indigestible, but rather on account of their physical qualities than their chemical composition. Instead of being porous and spongy, like bread, and readily absorbing the digestive juices which thus act on every particle of the bread, they are tough and non-absorbent, and are generally broken by the teeth into small fragments, which are only attacked on their surface by the digestive juices. In order to get rid of this objection, Pavy suggested the employment of almond flour, and this is now made into a biscuit, by Mr. Blatchley. Wheat, in addition to starch, contains a quantity of gluten, and when the starch is washed away, this remains behind. Biscuits made of this have been suggested by Bouchardat, and are made in France, whence they are imported into this country.[1] Bran, also, when the starch has been washed from it, may be made into biscuits, and used instead of bread.

Dr. W. Richardson, who himself suffered from diabetes, strongly recommends that the change from an ordinary to a restricted diet should be made very gradually, lest the patient become disgusted with his food. Rather than produce this injurious effect, it is better to relax the diet, and permit him to eat sparingly of bread made of whole meal, or even of white bread toasted and potatoes. Toasted bread seems to be less liable to cause sugar in the urine, although it is not easy to say why, unless it be that, being harder than untoasted bread, it is less rapidly acted on by the digestive fluids, so that the sugar it yields, instead of passing at once through the liver into the general circulation, is more gradually conveyed to this organ, and time thus afforded for its conversion into glycogen.

Such vegetables as consist almost entirely of cellulose, and contain little or no starch, as greens, spinach, cresses, and lettuce, may not only be freely used, but

[1] They are supplied by Bonthron, 106 Regent Street, and Van Abbot, 5 Princes Street, Cavendish Square.

ought to form a considerable part of the food. Those portions of the plants which are green consist chiefly of cellulose, and contain but little starch; the white parts of succulent plants, on the contrary, may contain a good deal, and had therefore best be avoided. The advantage of using green vegetables is that we not only enable the patient to vary his diet, and thus relieve the monotony of the diabetic regimen, but we give bulk to the food. It should not be forgotten that in Claude Bernard's experiments the sugar which he injected into the stomach of a dog appeared in the urine, but the same quantity did not cause glycosuria when introduced into the stomach of a rabbit, which is always more or less filled with undigested vegetable matter. By giving the patient, therefore, a quantity of insoluble vegetable matter along with those other parts of the food which will undergo digestion and afterwards pass to the liver, absorption of the soluble products of digestion will be more or less retarded, and more time will thus be given to the liver thoroughly to assimilate them. When patients, also, are put upon an almost exclusively flesh diet, the whole of it, or nearly so, being soluble in the intestinal juices, a very small residue remains behind, and the bowels are liable to become constipated. The addition of vegetables to the diet at once increases the bulk of the feces, and tends to relieve the constipation from which patients might otherwise suffer.

With the view of supplying the place of the sugar lost in the urine, Piorry recommended the free administration of cane-sugar, but this treatment is wrong in theory and useless in practice. Dr. Donkin has advised a diet consisting exclusively of skimmed milk, six to eight pints of which are to be given daily for ten or twelve weeks. Few patients can stand this treatment for more than a week. Of those who can some die of inanition, others do recover. The recoveries are probably due to the semi-starvation producing benefits similar to those seen in the siege of Paris. Lactic acid has been given with good results in doses of about two drachms daily. When given in such large doses as three ounces daily it has produced symptoms of acute rheumatism. The author recommended some buttermilk in place of lactic acid some years ago, but he has found that it is impossible to obtain it in town, and that even in the country it is difficult now to get it.

The quantity of food consumed by diabetics should be carefully supervised, as there is a tendency to eat more than is wanted, and more than is likely to be good for them; for it must be remembered that although sugar, when present in excess in the blood, causes many disagreeable symptoms, including languor and muscular weariness, it is not the only substance which will have this effect. The products of the decomposition of flesh have a similar action in causing muscular fatigue. While, then, we put our patients upon a diet in which nitrogenous substances form the chief ingredient, in order, by this means, to prevent the formation of sugar in excess, we must be careful lest the patient take so much flesh that even the products of nitrogenous waste may undergo imperfect combustion, as well as the sugar, and pass out as urates or uric acid in the urine. Even when this is not the case, and when combustion is thoroughly carried on, the quantity of urea may be so great as seriously to tax the excreting powers of the kidneys. Moreover, every ounce of meat above what is required for the maintenance of the body proves injurious, not merely in the way that has just been mentioned, but by using up so much oxygen in the blood, and thus interfering with the oxidation of the non-nitrogenous substances of the body, sugar included. Bouchardat states that during the siege of Paris he observed sugar entirely disappear from the urine of diabetics in whom it had to that time persisted, even though they had been living on a carefully regulated diet. The diminution in the quantity of food, which the scarcity prevailing during the siege had occasioned, thus effected that which alteration in quality had failed to accomplish.

The quantity of water drunk must be regulated by the thirst. It is not advisable to stint the patient's suppiy so as to cause inconvenience. But the ingestion of large quantities of water by a healthy man may cause inosite to appear in the urine, and increases the excretion of urea which is already excessive in diabetes. The patient should therefore drink no more than is necessary to quench his thirst, and in order to do this more easily water acidulated with lemon-juice may be used instead of plain water. Water should not be drunk during meals, but should be taken in the intervals between them.

Next to diet, exercise is of chief importance. It should be taken, as much as possible, in the open air, and the great rule regarding it is, that the patient should take as much as he possibly can without *exhaustion*. So long as the exercise does not exhaust, it is beneficial, but beyond this point it is injurious. It may be taken in a variety of ways—walking, riding, athletic sports, or gymnastic exercises, according to the circumstances of the patient.

Dr. William Richardson, who gives his own experience of the beneficial effects of exercise in diabetes, says:—"Ten years ago, when I was first seized with an acute

attack of diabetes, which threatened soon to end fatally, I became so weak, and had so little muscular power, that I could not walk a hundred yards without great fatigue. The muscles of my legs were so powerless that I fell two or three times; and in going down the slightest slope I had to pay unusual attention to my legs, or I was sure to fall. I began to take exercise regularly two or three times a day; wet or fine, I took it. Gradually I gained strength, so as to be able to walk five or six miles a day without fatigue. I now regularly walk from three to five or six miles a day." He also gives the case of a gentleman who derived but little benefit from a meat diet, Vichy water, iodide of potassium, or liquor arsenicalis, till he exchanged his sedentary life for active exercise, when his symptoms rapidly improved, and he soon recovered perfect health. The advice which Dr. Richardson gives regarding exercise seems to me to be so good that I take the liberty of quoting it. "The exercise should be regularly sustained day by day, even in wet weather it should not be intermitted; of course, great care should be taken against wet feet, and the shoes or boots ought to be changed in wet weather on returning home; it should never be carried to real fatigue; a feeling that exercise has been taken is the most that should be felt. To carry into effect regular and sustained daily exercise requires great moral courage and energy, the languor and feeling of weakness are so great; but if the exercise be only carried out patiently and perseveringly, the task will become not only more and more easy, but soon no longer a task, but positively a pleasure."[1]

Bouchardat also insists very strongly on the necessity for exercise, despite the languor of the patient, and recommends gymnastic exercises, which are best performed in a gymnasium, both on account of the better direction which the master of the gymnasium may give to the exercises, and because the company of others prevents the tedium which is apt to be felt when they are carried on alone.

The clothing ought to be warm, as the petients have less heat-producing power than healthy persons, on account of their diminished oxidation, which has already been considered under Pathology. Great care should be taken to avoid cold, and, when the patient can afford it, residence in a warm climate may be advantageous. Warm baths are beneficial, and a Turkish bath should be occasionally used. Amongst the remedies, the most effective are opium and its alkaloids. Opium seems to have been given by Aretæus, in the form of theriaca Mithridatis, and it was employed in certain cases by Aëtius. It was recommended also by Paracelsus, Rollo, Willis, and others.

Under the influence of opium, the thirst diminishes, the excretion of urine becomes correspondingly less, and the proportion of sugar present in it falls. Morphia has a similar action, and codeia, first recommended by Pavy, is even better, inasmuch as it can be given in large doses without producing drowsiness. Diabetics bear large, and sometimes enormous, doses of opium and codeia, and in administering both of these remedies it is well to push the dose until the sugar either disappears from the urine, or until increasing drowsiness obliges us to discontinue it. As much as thirty grains of opium, or several grains of morphia, and fifteen of codeia, have been given daily, not only without harm, but with great benefit. Senator recommends that the opium should be given in moderate doses from the very first, afterwards increasing until the excretion of urine is much diminished, when it should be discontinued for a time. He thinks it is best to reserve it for those occasions on which the diabetic, tired of a restrictive diet, returns to an admixture of farinaceous food. Both opium and its alkaloid codeia, however, may be frequently given continuously without harm. Other narcotics have not the same beneficial influence, although bromide of potassium has been found serviceable. Valerian is said by Lecorché to have an action similar to, though weaker than that of opium, and to be occasionally very useful in nervous cases. It should be administered in moderate doses, not exceeding thirty to fifty grains of extract in the day, given morning and evening for one or two months. Arsenic has been administered with varying result, sometimes having been of no service, at other times having been supposed to have effected cures. It has been more generally employed since the researches of Salkowski have shown that the livers of animals poisoned by it contain no glycogen, and that the puncture of the fourth ventricle in them does cause glycosuria.

In cases of diabetes depending upon imperfect formation of glycogen in the liver, arsenic could hardly be expected to be useful, and it is possible that the different results obtained by different observers in some cases depend upon deficient glycogenetic, and in others on imperfect glycogenic function of the liver. It should be given in doses of from three to thirty drops of Fowler's solution three times a day, but care must be taken not to push it so as to interfere with the digestion. Tincture of iodine, in doses of twenty to thirty drops per diem, sometimes diminishes the sugar rapidly, but,

[1] Richardson, On Diabetes, p. 91.

like the liquor arsenicalis, it must be watched so as not to interfere with the digestion.

Alkaline remedies were introduced by Willis in the treatment of diabetes, and successive authors have since recommended them in various forms and for different reasons.

About thirty years ago, Mialhe employed them because he supposed that they would accelerate the decomposition and combustion of sugar in the organism. It is quite certain that they often prove very beneficial, but their mode of action is not clearly made out.

It is quite possible, as Mialhe supposed, they do increase the combustion of sugar in the blood, but it is also possible that they prove beneficial by lessening the formation of sugar in the liver. Pavy found that on injecting caustic alkalies or their carbonates into the portal vein, no sugar was found in the liver shortly after death. On removing the superior cervical ganglion sugar appeared in the urine of the animals experimented upon, but if he injected carbonate of soda into the jugular vein before the operation, no glycosuria was produced. He was first led to make this experiment by finding that caustic alkalies prevented saliva from converting glycogen into sugar. He thus supposed that it would also prevent the diastatic action of other ferments, and this idea has been confirmed by the experiments of Lomikowsky, who found that when bicarbonate of soda was given to dogs for some time, little or no sugar was to be found in the livers, even when they were examined several hours after the death of the animals; but although sugar was absent, they contained a quantity of glycogen, and livers taken from other dogs to which no alkalies had been given, always contained sugar when examined in the same way. Alkalies may be given either made up as medicines in the usual manner, or in the form of natural mineral waters. Potash, soda, lithia, lime, and magnesia, or their carbonates may be given. All these have a local action upon the intestinal canal, in addition to the action which they exert upon the blood and tissues after their absorption. The salts which they form with organic acids, such as the citrates, tartrates, and acetates, have a less powerful action on the stomach and intestines, but after absorption into the blood the organic acid with which they are united undergoes combustion, and the salts just mentioned are all converted into carbonates and thus excreted in the urine, to which they give an alkaline reaction. In order to obtain a beneficial result, these medicines must be continued for several weeks or months, and it is therefore of importance to select a form which will interfere as little as possible with the digestion. For this purpose one of the best is the bicarbonate of soda, which may be given in doses of from three to six drachms daily, in either pure or aërated water. The tartrate or citrate of soda may be given in somewhat larger doses, and Bouchardat recommends that it should be mixed with bread instead of common salt. The corresponding salts of potash may be given, like those of soda, but they are more apt to disagree with the stomach. The citrates and tartrates are not entirely converted into carbonates before their excretion in the urine by diabetic patients, when they remain at rest, as they are by healthy persons. When the diabetics are made to take a great deal of exercise in the open air, however, the greatest part of the citrates undergoes combustion in the body, and becomes converted into carbonates before excretion.

Carbonate of ammonia has been recommended by Pavy, in doses of from two to six drachms in a day. Lime-water may be substituted for potash or soda if the bowels should become loose, and magnesia if they should be constipated. Sulphate of soda has not been found to be of any service, but rather to increase the sugar in the urine.

The two chief watering places for the treatment of diabetics are Carlsbad and Vichy. At Carlsbad there are numerous springs; those which are chiefly used are the Sprudel and Mühlbrunnen. The quantity usually drunk is about six or eight glasses a day. Under this treatment the sugar in the urine diminishes or disappears, and the symptoms of the disease disappear in a corresponding degree. The waters of Vichy have a similar effect, and are used in very much the same way. From the beneficial effect of alkalies it might be supposed that acids would be injurious, and this, indeed, as a rule, they seem to be, although, if the digestion has been deranged by too long continuance of the alkalies, a short recourse to acids for a few days may not only be free from injury but productive of benefit.

Astringents sometimes diminish the amount of sugar, but do not seem to produce any marked benefit. The best of them, according to Bouchardat, is slightly sour claret. Diabetics are frequently more or less anæmic, and the administration of iron is advantageous. It may be given either alone in the form of the perchloride, carbonate, iodide, or hydrate, or in combination with bitter tonics. The author finds a combination of fifteen minims of perchloride of iron with hydrochlorate of morphia very useful. The morphia is given at first in doses of one-twelfth of a grain, and it may gradually be increased. When the more powerful preparations of iron disagree, the hydrate in the form of

the dialysed iron will be found serviceable. Several ferments have been employed in the treatment of diabetes—yeast, pepsine, and raw meat. Yeast has been used by some with advantage, but in the hands of others its use has been followed by accidents, which might, or might not, have been due to the employment of the yeast, but which have rendered some chary of using it. Pepsine may be useful where there is derangement of the digestion, but it has little effect upon the progress of the disease. Raw meat was proposed some years ago by the author, with a view to supplying the ferment which converts sugar into lactic acid in the muscles, but the benefit actually derived from its use did not correspond with the expectations he had formed. [Schœtzke[1] reports the successful treatment of three cases of Diabetes with rather large doses of salicylic acid.—H.]

Treatment of the complications of the Disease.—The complications which arise in the course of diabetes require treatment somewhat modified by the presence of the disease itself. Cataract, so common in diabetic patients, is best treated by early operation. Neuralgias are not infrequent, and one might be tempted to employ subcutaneous injection of morphia for their relief, but in doing this it should always be remembered how prone any wound in a diabetic patient is to take on an unhealthy action. It is on this account that the use of the knife has been forbidden by some authors in the treatment of boils and carbuncles in diabetic patients, and it certainly seems advisable to do without it if possible. In the inflammations of internal organs to which diabetics are liable, stimulants must be freely employed, both because the patient is unable to utilize the nutriment which would in similar inflammations be given to sustain the strength of non-diabetic patients, and because the latter are liable to asthenic forms of inflammation.

On account of the danger of acetonæmia occurring in diabetics who suffer at the same time from gastric catarrh, the digestion ought to be carefully watched. To check the fermentative processes to which it owes its development, carbolic acid, salicylic acid, and thymol have been suggested, and during an attack it would seem advisable to empty the stomach by means of an emetic or stomach-pump, so as to prevent the absorption of any acetone which might be present there.

DIABETES INSIPIDUS.

By T. Lauder Brunton, M.D., F.R.S.

This disease is distinguished by great and persistent increase in the quantity of urine, with absence of sugar or albumen. It is generally accompanied by thirst, and sometimes causes wasting of the body.

History.—The disease termed diabetes by Galen and Aretæus includes cases of both diabetes insipidus and mellitus, for until Th. Willis suspected the presence of sugar in the urine in some cases and not in others, it was impossible to distinguish between them. Succeeding authors, however, left this ground of distinction almost unrecognized. About the middle of the eighteenth century, Sauvages distinguished diabetes mellitus from other diseases in which the amount of urine was greatly increased. Cullen observed that in some instances the urine was not sweet, and Franke distinguished between the two sets of cases by giving to the one the name of diabetes mellitus, and to the other that of diabetes insipidus.

Etiology. *Sex.*—Like diabetes mellitus, this disease occurs more frequently amongst men than women—the proportion being three men to one woman in both diseases.

Age.—It occurs at all ages, but seems, like diabetes mellitus, to be most common in adults. The period of maximum frequency, however, appears to be earlier than in the other disease, for Roberts, Strauss, and Van-der-Heijden, all agree in placing its maximum of frequency in the decade between twenty and thirty years of age.

[1] Berliner Klin. Wochenschrift, June 2, 1879.]

	Roberts.	Strauss.	Lacombe.	Van-der-Heijden.
Infancy	7	9	—	2
From 5 to 10 years . . .	15	12	2	5
" 10 " 20 " . . .	13	—	7	19
" 20 " 30 " . . .	16	57	5	23
" 30 " 40 " . . .	—	—	6	19
" 40 " 50 " . . .	15	—	—	9
" 50 " 60 " . . .	—	7	5	6
" 60 " 70 " . . .	4	—	1	4
Above 70	—	—	—	—
	70	85	26	87

A certain tendency to heredity appears to exist, and persons of a nervous temperament seem more predisposed than others to this disease.

Exciting Causes.—The chief exciting causes seem to be injury to the nervous system, such as blows on the head, tumors in the brain, hemorrhage, inflammation, and degeneration of the brain substance, sudden or powerful emotion, spinal meningitis, or such conditions as greatly increase the secretion of urine normally, *e. g.*, exposure to cold, which by checking the perspiration throws more work on the kidneys, the excessive use of spirits, large draughts of cold fluids, &c. Great physical exertion or violent muscular efforts have also occasionally been followed by the occurrence of this disease. It has also been observed to come on during recovery from fevers, either continued or remittent. Excessive variation of temperature seems sometimes to have occasioned it, and in other instances it has been observed as a consequence of privation.

Symptoms. — The chief symptoms of this disease are, the excessive quantity of urine secreted, and the consequences which this loss of water produces. These are thirst and diminished secretion from the other glands, such as the sweat and salivary glands, causing dryness of the skin, mouth, and fauces. Sometimes, instead of dryness of the mouth, there is ptyalism. As in diabetes mellitus, the skin, instead of being dry, may sometimes be normal, or subject to profuse perspiration. Boils, which so commonly occur in saccharine diabetes, rarely appear in diabetes insipidus, but the face is sometimes liable to erythematous congestion. The general health is often good. The appetite is usually moderate, though sometimes it may be excessive. The urine is passed in enormous quantities, even greater than in diabetes mellitus, and not unfrequently averages from fifteen to forty pints daily. Its quantity is greater than that passed by healthy persons drinking the same amount of fluids, probably because less passes off by the skin. There is also a difference in the effect of fluids upon the urinary excretion. When a healthy individual drinks a quantity of fluid, the quantity of urine becomes increased shortly afterwards, but the increase does not last long, whereas in patients suffering from the complaint now under consideration, the increase in the quantity of urine after the ingestion of fluids takes place slowly, but lasts a long time. The specific gravity is very low, sometimes being little more than that of pure water. On an average it is from 1,003 to 1,007. The urine is very pale, almost like water, its reaction is slightly acid, but it is more prone to alkaline decomposition than ordinary urine, and quickly becomes neutral or alkaline. The proportion of solids in it is greatly under the normal, but the total of the solids contained in the urine passed by the patient in twenty-four hours usually exceeds the normal quantity.

Robert Willis in 1830 distinguished three sorts of diabetes, according as the urea was increased, normal, or diminished. The first he called azoturia; the second, polyuria; the third, hydruria. The solids in the urine, however, coincide so closely with the amount of food ingested, that all these varieties might be produced in a single individual by alterations of the diet. Usually there is an increase in the amount of solids as well as in the water of the urine. The urea, sulphates, and phosphates are all increased in much the same proportion. Uric acid and creatinine are said to be diminished; hippuric acid has been observed in one case, and inosit has appeared in several, but inosit occurs in the urine of healthy persons who drink much water, and even, it is said, in larger quantity than in the urine of cases of diabetes insipidus.

Course and Duration.—This disease generally begins gradually and the secretion of urine, as well as the thirst which the loss of water from the body occasions, may continue for some time before they attract the attention of the patient. In other cases they may be preceded by prodromata, indicative of nervous disturbance, such as sleeplessness, headache, irritability, cramps, partial aphasia, and disturbances of sensibility and motion in the extremities. At other times the disease, like diabetes mellitus,

may begin suddenly, the patient's attention being attracted by the unusual quantity of urine he passes, or by his thirst.

A sudden onset has been observed during recovery from febrile disease, after injury to the head, exposure to cold, a fit of intemperance, violent muscular effort, and sometimes without any apparent cause whatever.

Except where it depends upon, or where it has been caused by some traumatic injury, its course is generally slow, and in one instance recorded by Willis, the patient affected lived for fifty years. Sometimes it seems to undergo intermission. The thirst and polyuria continue for some time, and then diminish, again reappearing with their former intensity. The disease is aggravated by violent emotions. Unlike diabetes mellitus, it seems to be very little influenced by diet. Intercurrent attacks of fever diminish both the thirst and the urine, at the same time that they increase the specific gravity of the latter. After these attacks have passed off the patient may either return to his former condition, or a permanent improvement may continue.

Excepting for the tormenting thirst and the annoyance caused by the frequent calls to micturition, the patient's health is often very little affected.

The duration of the disease varies much. It has caused death in as short a space as four months, but it usually lasts for many years. Sometimes emaciation sets in, the appetite fails, and the patient dies of exhaustion, but death generally occurs from some complication, such as inflammation of the lungs, or disease of the brain or cord. In the latter case, there may be affections of general sensibility and touch, hyperæsthesia or anæsthesia, headache, which may be either constant or intermittent, affecting the forehead or sinciput, trembling of the muscles, convulsive twitchings, and coma preceding death.

Pathological Anatomy. — Of the conditions found after death in this disease the most constant seem to be alterations in the structure of the kidneys and brain. In three cases out of nine Roberts found atrophy and degeneration of the renal substance, in a fourth the glandular tissue of the kidney was entirely wanting, in a fifth multiple abscesses were present in these organs, in two others the kidneys were hyperæmic and somewhat enlarged, in two others fatty degeneration of the nervous tissue was found in the walls of the fourth ventricle, and in one a tumor was present in the brain. Other authors have observed inflammatory and degenerative changes in the medulla oblongata and brain, tubercular or sarcomatous tumors involving these parts of the nervous system, syphilitic exostoses on the cranial bones, enlargement of the mesenteric glands, and degeneration of the solar plexus.

Pathology.—The researches of Claude Bernard and others have shown that diabetes mellitus, in many instances at least, probably depends on dilatation of the hepatic vessels and a freer flow of blood than normal through the liver. The pathology of diabetes insipidus appears to be somewhat similar, only that the renal vessels are dilated instead of the hepatic ones. The diameter of the bloodvessels, both of the kidneys and the liver, is regulated by the vaso-motor centre in the medulla oblongata. The nerves of the kidney pass down through the spinal cord and the splanchnics, and along the renal artery to the hilus. When they are divided as they pass along the renal artery, the flow of blood through the kidney is increased, the pressure in the glomeruli becomes greater, and the urine is secreted more abundantly. When the spinal cord, or the splanchnics themselves are cut across, the secretion is diminished instead of increased, because the vaso-motor nerves of the intestines are divided as well as those of the kidney, and just as we have seen in the case of the liver, the secretion through the kidneys is diminished by the blood going to these other vascular districts instead of flowing through the renal vessels. Like the hepatic vessels also, the renal arteries may be dilated reflexly by puncture of the floor of the fourth ventricle, by irritation of the central end of the vagus, or by injury to certain parts of the cerebellum.

Not only can the profuse secretion of urine in diabetes insipidus be explained by the supposition that in it the renal arteries are in a state of permanent dilatation, but this hypothesis also affords an explanation of the difference between the effect of fluids on the urinary secretion in patients suffering from this disease and healthy persons. In the latter the ingestion of a quantity of fluid seems to cause increased determination of blood to the kidney and rapid secretion of urine. The excess of water is thus quickly removed from the blood, and the urine soon falls to its normal standard. In cases of diabetes insipidus the renal arteries are already fully dilated, and any addition of water to the blood consequently has but slight power to increase the renal circulation. The urinary secretion is therefore not increased in the same way as normally, but the increase, although slight, goes on for a longer time, until all the excess of fluid has been removed from the blood. Some authors have been disposed to look upon the thirst and polydypsia as the primary condition, and the polyuria

as merely consequent upon them. This view, however, is probably incorrect, and treatment based upon it has proved unsuccessful. When the quantity of liquid allowed to patients suffering from diabetes insipidus has been limited, the excessive thirst has induced them even to drink their own urine, and when the supply of drink has been completely cut off, the secretion of urine appears to go on at the expense of the tissues, the patient becoming thinner on account of loss of water from the body. An examination of the blood in this disease has shown it to be comparatively poor in water, and rich in solids. These conditions point to the polyuria as the cause of polydypsia. It has already been mentioned, in the article on diabetes mellitus, that if the kidneys be artificially stimulated to secrete urine, thirst is produced.

The diminution in the sweat and salivary secretion, and the consequent dryness of the skin and mouth, are probably simply results of the abstraction of water from the body by the kidneys.

The salivation which has sometimes been observed in diabetes insipidus has been attributed to irritation of the nerve centres, for Eckhardt, Nöllner, Külz, and Grützner have found that puncture of the floor of the fourth ventricle close to the point which causes polyuria will produce ptyalism in dogs and rabbits. The increased amount of urea depends chiefly on the quantity of nitrogenous food eaten, for in a case recorded by Dickinson the urea varied from six to twenty-four grammes, according to the nature of the diet.

If more butcher meat than the average be taken, the amount of the urea excreted will certainly also rise above the average. Similarly, diminution in the quantity of nitrogenous food will undoubtedly produce a corresponding diminution in the quantity of urea.

The ingestion of such a large quantity of water may also be to some extent the cause of the increase in the urea, for it produces this effect even in healthy persons.

Diagnosis.—It is well known that the quantity of urine may be temporarily very much increased above the normal by many conditions, such as anxiety or fear; arrested secretion of the kidneys, as, for example, by sudden exposure to the cold, especially if the patient has been accustomed to warmth for some little time, or the ingestion of a large quantity of fluid such as will occur after indulgence in highly spiced and salt provisions. In hysteria also, the patient is liable to secrete enormous quantities of urine. This only takes place after a fit, and is not persistent, while the polyuria in diabetes insipidus is permanent. The most important condition with which this disease is likely to be confounded is granular kidney. From this it must be distinguished by the absence of albumen in diabetes insipidus, and its presence, though sometimes only in very small quantity, in cases of granular kidney.

Prognosis.—This disease resists treatment, and is rarely cured. The duration of life, in general, does not seem to be greatly shortened by it. Trousseau, however, regarded it as a more serious disease than diabetes mellitus, and as running a somewhat similar course. The cases observed by him appear to have been those in which the appetite was greatly increased, and he states that the bulimia is succeeded by anorexia, diarrhœa, and wasting, the skin becoming withered, the breath fetid, and sometimes by phthisis.

It would thus seem that excessive appetite is an unfavorable symptom in this disease, while a normal appetite is prognostically favorable.

Treatment. — Numerous remedies have been employed in this disease, but with comparatively little effect. Acting on the notion that the polyuria was a consequence of polydypsia, patients have been put on a limited allowance of fluid, but without any good result, the tormenting thirst becoming increased, and the general condition worse. Diuretics, such as nitrate of potash and cream of tartar, have also been used, and the former was lauded by Franke as a certain remedy. Subsequent observations, however, have not substantiated this opinion. Nervous tonics and sedatives have both been employed. Opium at once suggests itself as a most likely remedy, from its great efficacy in diabetes mellitus, but the hopes entertained regarding its utility have not been fulfilled. In some instances it renders the patient worse. Camphor, valerian, and valerianate of zinc have all been found useful, valerian especially being recommended by Trousseau as the best remedy. Iron, ergot, strychnia, turpentine, balsam of Tolu, copaiva, and acetate of lead have all been tried with more or less success.

In cases where the disease probably depended upon some lesion of the nervous system of syphilitic origin, mercury and iodide of potassium have proved efficacious. Acting on the hint afforded by the temporary suspension of thirst and diuresis during an intercurrent febrile attack, Roberts recommends the application of a large blister to the nape of the neck or the epigastrium. Galvanism has been found useful. It may be applied either by placing one pole on the nape of the neck and the other on the loins or epigastrium, or by one pole over the loins and the other pressed deeply into the corresponding hypochondrium, first on one side and then on the other.

DISEASES OF THE URINARY ORGANS.

A. Kidneys.
- Nephralgia.
- Diseases of the Renal Blood-vessels.
- Hæmaturia.
- Endemic Hæmaturia.
- Hæmatinuria and Paroxysmal Hæmatinuria.
- Albuminuria.
- Congestion.
- Bright's Disease.
- Consecutive Nephritis and Pyelitis.
- Calculous Disease.
- Hydronephrosis.
- Abscess.
- Growths.
- Anomalies of Form and Position.

B. Ureters.

C. Bladder.

NEPHRALGIA.

By W. R. Basham, M.D., F.R.C.P.

Derivation.—νεφρὸς, the reins or kidneys; ἀλγος, suffering or pain; hence νεφραλγια, pain in the kidney.

Definition.—Pain, uneasiness, or discomfort in the lumbar region, extending from one or other kidney through the ureter to the neck of the bladder and extremity of the urethra; accompanied by great and often distressing frequency of micturition; without febrile disturbance or other symptoms of inflammatory action, but with evidence of sympathetic irritation in parts connected with the kidneys through the solar, renal, intestinal, and spermatic ganglia, as shown by nausea, vomiting, pain in the testicle, and numbness more or less marked in the outer cutaneous surface of the thigh, through the connection of the external crural cutaneous nerve with the ganglia above mentioned. The urine is sometimes scanty, more often abundant, highly acid, with or without sedimentitious deposits, but frequently with crystalline or amorphous sediment—lithic acid or lithates of ammonia or soda—(red sand or gravel), and frequently exhibiting in the field of the microscope oxalates of lime crystals (*Oxaluria*); mucous or exudation corpuscles are more abundant than in health, and form a flocculent cloud when the urine has been set at rest for an hour or two.

Nephralgia is symptomatic of lithæmia, lithiasis (lithuria), oxaluria, calculous disease of the kidney, malignant and tubercular disease of this organ.

Etiology.—The most common cause of nephralgia is lithæmia, a redundancy of nitrogenous excrementitious matter in the shape of lithic acid, retained in the organism. It may accumulate from imperfect oxidation and conversion into the more soluble and more easily excreted urea: or it may be formed largely in excess of what the organs are capable of excreting, or, as happens sometimes, constitutional idiosyncrasy or hereditary causes may, in spite of all care and management, develop a tendency to this state of lithiasis, just as gout will show itself hereditarily in opposition to every effort to control it. Redundancy of lithic acid will show itself in various ways. Thus it may appear as crystalline grains deposited from the urine as it cools, constituting red sand, often likened to cayenne pepper grains; these are for the most part rhombic, lozenge, barrel, stellar-shaped crystals of lithic acid. Or the sediment may be of a brick-dust red (lateritious), non-crystalline in the mass, but presenting many octahedra of oxalate of lime among the granular masses of lithates of ammonia and soda of which the sediment is largely composed. The red color is due to some molecular change which the lith-

ates have undergone, by which purpurine-urerythrine has been abundantly formed, a condition of the urinary sediment always connected with hepatic and gastric derangement. The appearance of this sediment in the urine in cases of nephralgia is always favorable to the ready subsidence of the symptoms. But the lithic acid may not be so readily excreted. It may be so much in excess as to lead to the retention in the tubules of the kidney, either of crystalline grains or of deposits of non-crystalline lithates, which, while lodged within the tubular structure, will excite continuous irritation, even to the extent of simulating symptoms of calculus of the kidney. Such crystalline deposits in the tubules of the kidney have occasionally been demonstrated in post-mortem examinations. These concretionary masses are, after a time, washed out of the large straight tubes by the urinary current, and will pass down the ureters into the bladder, being voided through the urethra as sand or gravel, and that may be collected in the urinary sediment. These conditions give rise to the more serious and persistent symptoms of nephralgia, and should any portion of these masses not freely escape, but be detained in its original position in the tubular structure, or in its passage become lodged in any of the cup-shaped expansions of the pelvis of the kidney embracing the pyramids, slowly but continually, it will increase in bulk, and eventually develop the characteristic symptoms of renal calculus or of calculous pyelitis, often preceded by severe nephralgia and renal colic.

Nephralgia is also occasionally met with in tubercle of the kidney as well as in malignant diseases of those organs.

Symptoms.—It is seen from what has been stated above that nephralgia is not symptomatic of one, but of several disorders of the urine and urinary apparatus; and that various forms of renal disorder, both organic and functional, may develop the group of symptoms which has been embodied in its definition. It becomes therefore of practical value to establish a differential diagnosis between the several affections which have such a group of symptoms in common. Nephralgia may be intermittent and paroxysmal, or it may be persistent and continuous. In the first division it is the usual concomitant of lithiasis, whether in the form of urine highly charged with lithic acid, soluble while passing through the passage, but forming a crystalline deposit after the urine has cooled; or in the other form where the lithic acid exists in the form of sand or gravel, its insolubility, while within the organism, being dependent on its proportion, this being in excess of what the acid phosphate of soda can hold in solution. In this it is therefore symptomatic of functional disturbance, and holds out the prospect of being amenable to treatment.

In the second division, the symptoms being more or less persistent, it is usually attended by conditions, both of the urine and of the general health, which indicate a disorder more decidedly organic, and affecting the integrity of the renal organs themselves.

The simplest and most amenable form of nephralgia is that excited by the lowest form of lithiasis—that in which a more or less copious deposit of red crystalline grains of lithic acid is formed on cooling. A certain amount of lumbar pain, an aching uneasy sense of weight, may at random be called nephralgia; but unless the pain or uneasiness be accompanied by some special conditions to be presently described, the term would be misapplied—thus lumbago has been often mistaken for nephralgia.

The character of the pain in nephralgia is almost as various as the patients who suffer—or, in other words, hardly any two patients describe their sensations alike. Sometimes the pain is shifting and irregular, extending to the crest of the ilium, and then downward, following the course of the ureter, on one side or the other, with a sense of aching or uneasiness referred to the extremity of the urethra, with a frequent desire to pass water, which is accompanied by a sense of heat or even scalding in the urethral passage. This more frequently occurs in women. Other sensations are described by patients having much the character of rheumatism, the large cushion of the gluteal muscles being their seat. Uneasy sensations referred to the muscles of the thigh, with a sense of numbness in the cutaneous surface, are not infrequent. These symptoms are invariably accompanied by increased frequency of micturition, which at once gives the true interpretation to their origin, and refers them to sympathetic irritation derived from the renal organs, and not originating as rheumatic pains in the several muscles themselves.

The urine in many cases has no morbid character visible to ordinary observation, but when chemically and microscopically examined, lithic acid is found largely in excess of the healthy average. The sediment often exhibits red crystalline grains, and, adherent to the inner glazed surface of the chamber vessel, bright orange-red grains of lithic acid are precipitated. When such urine is allowed to cool in a glass vessel, these red crystalline grains of lithic acid are seen in abundance adherent to its sides. Lithic acid may be thrown down in still greater excess, forming rapidly a perfect crystalline precipitate of a

yellowish red sand, which microscopically consists of the many forms which lithic acid assumes in its crystalline shapes.

The nephralgia coexisting with this abundant excretion of lithic acid is rarely accompanied with any great disturbance of the general health. It may cease spontaneously; or it may cease in a few days under judicious treatment, and may return as the result of some dietetic imprudence. It may thus return at intervals for years, or it may eventually, particularly by careful diet, disappear altogether, but the majority of individuals are careless of the future, and unmindful that these attacks are the premonitions of the gouty diathesis, and are but too frequently the precursors of a genuine attack of gravel.

The nephralgia coexistent with the passage of gravel differs in no respect except in degree from that which is developed by lithic acid in excess. The most uniform diagnostic group of symptoms consists in a constant irrepressible desire to pass water, although but a small quantity may pass, attended, or it may be more properly said, preceded, by a darting pungent pain at the neck of the bladder and extremity of the meatus urinarius—which is momentarily relieved by the act of micturition—to return again and again after shorter or longer intervals, relieved each time by the passage of the small quantity of urine present in the bladder, and returning so soon as a very small quantity has accumulated. Each act of micturition is accompanied by a burning, cutting pain along the urethra, as if the passage were denuded of its protective epithelium. In mild cases the urine is not at first turbid; on settling in a glass vessel a coarse sediment falls, of a fawn color, and composed of particles like coarse sand or even gravel. This sediment is partly crystalline and partly noncrystalline. The first shows many of the crystalline forms of lithic acid. The latter presents an amorphous appearance, granular, with minute globular particles, which further analysis proves to consist of lithates of ammonia and soda.

If the attack of gravel be prolonged, and the particles acquire a coarse and gritty character, isolated blood-disks may be seen in the field of the microscope, proclaiming the presence of blood in minute quantity, and even heralding an attack of hæmaturia. In these cases the appearance of the crystalline forms of lithic acid are particularly suggestive of the possible occurrence of hemorrhage as the result of local irritation. They are distinctly stellar, made up of acicular crystals conjoined in their centre, and it is very easy to conceive how much more pungent and painful must be the passage of such crystalline masses over the surfaces of the tubes and outlets of the kidneys. The urine in such cases is generally of average specific gravity, and occasionally contains a small amount of albumen, which is usually only proportionate to the number of blood disks present. In old gouty cases the larger proportion of albumen must excite attention to the probability of the existence of a gouty contracting kidney.

Nephralgia symptomatic of the more serious affections associated with the renal apparatus, namely, calculous, malignant, and tubercular disease, is accompanied with the other clinical phenomena which are characteristic of each of these complaints, and these are described in separate articles.

TREATMENT.—A paroxysm of nephralgia with its urgent and distressing symptoms, if arising from a lithuria or lithiasis, that is, from an abundant excretion of lithic acid, and the passage through the renal organs of a highly acid urine, or of urine surcharged with crystalline grains of lithic acid, is usually very amenable to judicious treatment. Two therapeutic objects must be kept in view:—

Firstly, the neutralization of the highly acid and irritating urine.

Secondly, the use of remedies to excite the sluggish and imperfect hepatic function, which must be regarded as the remote cause of the urinary disturbance.

To attain the first object without considering the necessity of the second would be only temporarily, and for a very short period, to afford relief to the patient. Keeping both objects simultaneously in view, complete relief is quickly obtained.

According to habit or idiosyncrasy of the patient, the treatment should begin with either a brisk mercurial purge, or, what is better, with small alternate doses of blue pill and rhubarb, to be followed each morning with some neutral saline. The Carlsbad, Püllna, or Friedrichshall waters are most efficacious. Moderate quantities—a few ounces—should be taken warm, either every morning or on alternate mornings, while the patient is fasting. The bicarbonate of potash, with or without some salt of lithia, should be taken twice or three times a day in an effervescing form with lemon-juice. To render these measures more promptly remedial, a strict attention to diet should be enjoined. Animal food should be restricted; and wine, beer, and other stimulants given up, or if that be not done, then their quantity, quality, and the period of the day when they are taken must be strictly regulated.

In regard to stimulants it may be said of them all that the mischief they are capable of producing is largely propor-

tional not only to the quantity taken, but to the time when taken. On an empty stomach they produce the maximum amount of injury; taken with food the evil is then proportional to the quantity and kind. Taken on an empty stomach the injury is twofold :—1. On the gastric glands and mucous surface of the organ, by which the primary stage of gastric digestion (when subsequently called into action) is weakened and damaged. 2. The alcoholic fluid passes undiluted or unmodified into the portal system and hence disturbs and deranges the important function of the liver; and it may lead eventually to disorganization, obstructed circulation through the organ, ascites, hepatic dropsy, and death.

In the treatment of simple nephralgia, those stimulants possessing a limited action are preferable to those more distinctly acting as alcoholic excitants. All are better avoided; but it so frequently happens that those suffering from nephralgia have become habituated to their use, that it is not advisable, indeed it is impracticable, to forbid their use altogether. Selection should therefore be made of those which are best adapted to the remedial agency required. In addition to the main object of treatment—the cutting off the formation of lithic acid in excess—must be the evacuation from the renal organs of any portion already formed and detained within the renal tubes. This point is attained by the use of those stimulants only which possess a diuretic action. Gin, hollands, or whiskey in moderate quantities, largely diluted, will keep the renal tubes well washed by the copious stream of a diluted urine, which effectually carries away any irritating grains of lithic acid lodged in them. The stimulants to be avoided are all the strong and heady wines—port, sherry, and madeira; all effervescing wines, especially the sweeter or more fruity sorts of champagne; all the sparkling varieties of hock or burgundy; all kinds of beer, whether in draught or bottle; all liqueurs. On the other hand, the wines best suited for these disorders are all the light kinds of claret, or various kinds of hock diluted with seltzer-water.

The amount of animal food should be reduced and limited to one meal daily, and the diet otherwise regulated according to the character of the dyspeptic symptoms experienced by the patient.

Connection of Lithæmia, Lithiasis, Oxaluria, and Hypochondriasis.

Nephralgia arising from lithiasis is so intimately connected with symptoms of other functional disorders, that the subject would be incomplete without a review of their most prominent and characteristic features. These are chiefly referable to the digestive process, either in the primary or secondary stages; and to the influence of such imperfect processes on the nervous and circulating systems.

They may be enumerated as inappetency; flatulence and uneasy sensations after food; acid eructations and heartburn; torpid bowels; defective taste; mental depression or hypochondriasis; and intermittent or irregular pulse. In these cases the nephralgia is by no means a leading symptom. There may be some frequency in micturition, the urine passed being small in quantity, highly acid, and containing lithic acid crystals, deposited on cooling. This sediment, when examined with a microscope, is seen to consist of crystalline grains of lithic acid, mixed with a large proportion of octahedral crystals of oxalate of lime. In many cases the sediment consists entirely of these octahedra.

The coexistence of this form of sediment with the symptoms of gastric disturbance, nervous and mental depression (hypochondriasis), and irregular and intermittent pulse, induced some writers on urinary pathology, notably Prout and Golding-Bird, to refer these several disturbances in the gastric assimilation, nervous, and circulating functions, to one common cause, under the definite term of *Oxaluria*, or the *Oxalic acid diathesis*.

Dr. Prout,[1] who first described the symptoms of this diathesis, believed them to belong to the irritable or nervous class, rather than to the congestive or inflammatory. He stated that they were marked by irregularity of the heart's action, intermission of the pulse, palpitation, flatulent disorder of the stomach, with more or less hypochondriasis, depression, and low spirits.

Dr. Golding-Bird endorsed these views, and added, by his popular work on urinary deposits, still further to the belief and recognition of the diathesis under the term, first employed by him, of *Oxaluria*. There were, however, not wanting physicians and chemists who expressed themselves as sceptical of this oxalic diathesis. Among the earliest writers who entertained doubts of this oxaluric theory was Dr. Owen Rees. In his work, published in 1845, "On the Analysis of Blood and Urine in Health and Disease," he observes :—"The state of the system on which the secretion of urine characterized by deposits of oxalate of lime depends is not well investigated. There appears some degree of probability that it is connected with the formation of lithic acid in excess, and with a state of system in which a considerable quantity of urea is

[1] Stomach and Renal Disease, p. 62 et seq.

secreted." Still later, in the Croonian Lectures for 1856 at the College of Physicians, Dr. Owen Rees affirmed that oxaluria was not indicative of a diathesis, but that the oxalate of lime was formed after the urine had been secreted by the kidneys, and was derived from the uric acid and urates of the secretion. It is remarkable how long an erroneous theory will prevail when originating with observers of reputation. There are many who yet view oxaluria as a distinct disorder, and who consider it to be something entirely different from the lithic acid diathesis, and continue to accept the view of Golding-Bird that the irritable form of dyspepsia, with nervous depression and hypochondriasis, already mentioned, are symptoms peculiar to the presence of oxalate of lime, rather than common to a state of lithæmia with corresponding excess of lithic acid in the urine. To prove that lithic acid is the only source and origin of oxalic acid and the oxalates in the urine, it will be necessary to trace the formation of oxalic acid, and to show, first, that perfectly fresh urine presents no trace of oxalate of lime crystals, and that it is only after a short exposure to the air that they become visible in the sediment.[1]

In tracing the source of oxalic acid in the urine, the ready formation of it by the oxidation of most organic compounds must not be disregarded. It is abundantly formed by the oxidation of sugar by nitric acid, also by the decomposition of the urate of ammonia, whether obtained from human urine or from the same compound contained in guano.[2] The chemical relations of oxalic acid to lithic acid and the lithates have been investigated by chemists of the highest reputation, and all concur that the oxalic acid is one of the products of the oxidation of these organic excretions. The following facts sufficiently prove this proposition:—

Lithic acid is converted into oxalic acid and urea by the addition of oxygen and water.

Lithic acid, mixed with a fermenting agent (yeast) and an alkali, with an elevation of temperature, is decomposed into oxalic acid and urea.

Lithic acid, heated with water and peroxide of lead, is converted into urea, allantoin, oxalic acid, and carbonic acid (Wohler and Liebig).

Lithic acid, digested in chlorine water, forms alloxantin, alloxan, parabasic acid, and oxalic acid.[3] Lithic acid oxidized by nitric acid yields a large quantity of parabasic acid, oxalic acid, and ammoniacal salts.[1]

Examples might be multiplied to prove that the oxidation of lithic acid always results in the formation of oxalic acid, urea, and other compounds. The lithates undergo similar decompositions.

It is well known that Peruvian guano, which is almost pure lithate of ammonia, becomes converted in the hold of the ship very largely into oxalate of ammonia. These facts not only support, but prove the opinion expressed so many years since by Dr. Owen Rees, that the oxalate of lime is formed after the urine has been excreted by the kidneys, and is derived solely and directly from the decomposition of lithic acid and the lithates. But the subject has been still further and successfully investigated by Edward Schunck, F.R.S., in a paper published in the Proceedings of the Royal Society, "On Oxalurate of Ammonia in the Urine."[2]

The process for obtaining the oxalurate is given in detail. Whether the oxaluric acid exists originally in a free or combined state is a matter of doubt, for it is quite possible that the ammonia may be derived from the decomposition of the urea present in sufficient quantity to saturate the oxaluric acid present. With regard to the origin and source of the oxaluric acid, Mr. Schunck distinctly states that there can be little doubt that in the animal frame, as in the laboratory, it is formed by the oxidation of lithic acid, which is its only source. This conversion of oxaluric acid into oxalic acid and urea may take place in any part of the urinary apparatus, or only in the urine after excretion and exposure to the air. Few organic compounds are so unstable or so readily undergo decomposition as the oxamic series. Acids, alkalies, or even water at a certain temperature, will decompose oxaluric acid. Urine containing oxaluric acid will, by simple exposure to the air, yield oxalic acid and urea, and consequently crystals of oxalate of lime. In the majority of cases perfectly fresh urine contains no oxalate of lime,[3] while the same urine, after a short exposure to the air, exhibits abundant evidence thereof. The same urine boiled exhibits similar results.

The decomposition of oxaluric acid may take place in any part of the urinary apparatus after the urine has been once secreted; and hence an intelligible explanation is offered of the formation of oxalate of lime, whether in the urine only and subsequent to exposure to the air, or

[1] Lehmann, Physiological Chemistry, vol. i. p. 44.

[2] Gmelin, Handbook of Chemistry, vol. ix. pp. 111 et seq. Cavendish Soc. Edition.

[3] Ibid., vol. x. p. 460.

[1] Gmelin, Handbook of Chemistry, vol. ix. p. 462.

[2] Proceedings of the Royal Society, vol. xii. No. 95.

[3] Lehmann, Physiological Chemistry.

even within the renal tubes, as must happen in cases where oxalate of lime calculi are formed, or even in lithic acid calculi, the nucleus of which is so frequently found to be composed of this oxalate of lime salt.

The oxaluric acid, on its combination with ammonia, rapidly undergoes decomposition when brought into contact with either acid or alkaline salts, and therefore will, in the presence of the acid phosphates, or even of the basic phosphates of soda in the urine, become converted into oxalic acid and urea, and the former, with its powerful affinity for lime, would, at the moment of formation, unite with or decompose the lime salts always present in the urine. Mr. Schunck very justly concludes that this oxalate ($C_2N_2H_2O_3$) may be considered the vehicle by which the oxalic acid escapes from the system in the least injurious form.

Such are the leading and most characteristic chemical relations of oxalic acid to urea, lithic acid, and the lithates, and in the face of these chemical facts it must be admitted that the opinion expressed by Dr. Owen Rees, as to the probable derivation of oxalic acid and its oxalates from lithic acid, is fully established and confirmed.

All urines, therefore, whether from persons in health or suffering from diseases of the most varying character, may at times contain oxalate of lime crystals. They are, consequently, not significant of nervous depression or hypochondriasis, or of irregular or intermittent pulse, or of any special form of dyspepsia, any more than they are significant of emphysema, chronic bronchitis, phthisis, or even diabetes, in all of which disorders an abundant sediment of oxalate of lime is occasionally found.[1]

The chemical facts already stated may, it is hoped, dissipate that chaos of opinion which the late Dr. Parkes so emphatically stated to exist on this subject.

Oxalate of lime as a sediment in the urine is of no other significance than that of a lithic acid diathesis (lithiasis). When seen in urine immediately on being passed, and before such urine has had time to cool, it may signify that the oxalurate of ammonia has undergone molecular change within the urinary or renal passages, and the formation of an oxalate of lime calculus is thus considered possible.

The symptoms then of the disorder which Dr. Golding-Bird designated as oxaluria are closely associated with, if not entirely dependent on, a state of the organism which Dr. Murchison has very appropriately termed lithæmia,[2] a condition in which oxidation is imperfectly performed, and insoluble combinations of lithic acid and lithates, instead of the readily soluble urea, are the results. This state of lithæmia, with its concomitant condition of lithiasis, and deposit of oxalate of lime crystals, exhibits all the characteristic and typical symptoms of the oxaluria of Golding Bird, namely: More or less frequency of micturition, occasional sense of heat, or even scalding, along the urethral passage, dyspeptic symptoms of varying character, flatulent disturbance after food, irregular and frequently intermittent pulse, with occasional attacks of palpitation, sluggish torpid bowels, depression of spirits assuming the character of hypochondriasis, restless nights and unrefreshing sleep, with its attendant feeling of weariness and languor. These symptoms are most commonly met with in persons of indolent habits, in dyspeptics, whose errors of diet and regimen lead prominently to defective liver formation, and they are not rarely seen in those whose occupations, literary or professional, subject them to great mental strain, and who, from prolonged mental occupation, are deprived of the exhilarating influence of air and exercise. Hypochondriasis in these cases is frequently accompanied by various delusions, of which the most common relates to the sexual functions, a dread of impotency becoming the predominating thought; or if this be not the form, then some subjective symptom occupies the mind, and the enjoyment of life is subordinate to its influence.

TREATMENT.—In considering the treatment of this group of functional disturbances, it is most essential to keep prominently in view the pathological fact that it is not the kidneys that are at fault, whose office it is to excrete from the organism such products of the disintegration of the tissues as the process of oxidation has prepared for excretion, but rather those organs which minister to perfect assimilation, and are engaged in the important office of separating the excrementitious from the recrementitious.

The hepatic function is that to which attention should be chiefly directed. Medicinal treatment may do something, but diet and regimen can do more for the relief and cure of this class of disorders.

Whether the symptoms take the form of nephralgia, with its frequency of micturition, its lumbar pains and sympathetic sensations, its highly acid urine, with a sediment of lithic acid crystals (red sand), or are in the aggregate more allied to a wider range of disturbance, and which have been described under the name of oxaluria, in which the gastric, hepatic, nervous, and circulating systems are more

[1] See Parkes On the Urine, p. 221; also Roberts, Urinary and Renal Disease, p. 51.

[2] Functional Diseases of the Liver, p. 72 et seq.

obviously at fault, the etiology of each being the same, the treatment, whether medicinal or dietetic, will not greatly differ. Looking to the fact that in this group we have to treat a lithæmia, with its accompanying lithiasis, the latter condition varying only in intensity, it may be conceded that the principles of treatment appropriate to one will be equally applicable to the other.

In the graver form of oxaluria, in which so wide a range of disturbance exists, torpid sluggish bowels, inappetency, or at least depraved gustatory sense, irregular and intermitting pulse, with hypochondriasis more or less marked, severally indicative of functional hepatic disturbance, the chief aid medicinally will be derived from alterative doses of blue pill with rhubarb, avoiding, except in special cases, the employment of active mercurial or resinous purgatives. There are no remedies which assist mild mercurial doses so efficaciously as some of the purgative bitter waters—the Friedrichshall, the Püllna, the Marienbad, the Carlsbad, or the Hunyadi Janos—all of which are most efficient as laxatives, and are most beneficent in these cases of hepatic torpor or lithæmia. They are especially beneficial when the symptoms are expressive of a gouty diathesis.

When these alterative measures have relieved the patient to the extent of obtaining improved and daily action of the bowels, the digestive powers will be materially strengthened by dilute hydrochloric acid and infusion of gentian, or, in some cases, by the nitro-muriatic acid with some vegetable bitter. These, if taken a short period before food, rapidly improve the appetite, and with an improved digestive process some of the leading symptoms will slowly subside. The mental depression gives way to a more cheerful tone; the sleep becomes sounder and more refreshing; the urine slowly loses the crystalline oxalate of lime, while the lithic acid returns to its natural proportion, and, so far as the urinary secretion is concerned, all evidence of disturbed function has disappeared. Nevertheless, among the symptoms which are typical of this form of disorder, the irregularity of the pulse, with its marked intermissions, will continue for weeks after the major symptoms have disappeared. To the hypochondriac, who habitually feels his own pulse, the continuance of this irregularity often leads to the belief in the patient that he is the subject of heart disease, and it is difficult sometimes to persuade him otherwise. The intermission is simply a pulseless systole. In ordinary cases there is no intermission of the heart's motion; all that can be detected by auscultation is a somewhat feebler impulse and a less vigorous sound corresponding to the systole. It would seem that the quality of the blood does not impart a stimulus sufficiently powerful to send the pulse-wave fully and strongly throughout the arterial system. Irregularity of the heart's action may exist also in these cases. This symptom consists of a few beats at an ordinary rate followed by several of double or treble rapidity, now and then a marked intermission intervening. This irregularity in the pulse may, however, be indicative of organic disease, and is of graver import than an intermitting pulse. Nevertheless, the coexistence of irregularity with intermission is usually dependent on a like cause, blood surcharged with the effete material, and unequal to conveying a healthy and vigorous stimulus to the heart's action. This irregularity, therefore, is not produced by any organic defect in the heart itself. Auscultation fails to find any adequate cause for it; and the patient may have his apprehensions of organic disease of the heart allayed.

The patients in whom these suspicious heart symptoms arise are usually of robust frame and make, enjoying good health in early life, of active bodily habits, and generous livers, rather inclined to obesity than otherwise, and who, from accident or necessity, have been debarred from their usual active exercise.

The following is a typical case:—A gentleman, a landed proprietor of good estate, fifty-five years of age, following eagerly the exhilarating sports of a country life, met with a severe accident in the hunting field, a fractured thigh and humerus, and was consequently compelled to give up hunting, and subsequently also shooting. He became dyspeptic, suffering much flatulence, with sluggish bowels, occasional palpitation and fluttering in the cardiac region, with irregular and intermitting pulse. A state of hypochondriasis followed, with loss of sleep and defective appetite, and the flatulent distension after food was so great that a sense of choking, with much shortness of breath, alarmed him into the fear that he was becoming asthmatic. The urine was clear, non-albuminous, highly acid, a slight sediment showing crystalline grains of lithic acid, with an abundant crop of oxalate of lime octahedra. Constantly feeling his own pulse, he became possessed with the belief that he was the subject of heart disease, and this preyed so much upon his mind that, after sleepless nights, he became so low and depressed as to give fear to his family that his mind would give way. The intermitting and irregular pulse was most marked, sometimes an intermission every third, fifth, and tenth beat. The sounds of the heart were feeble,

and now and then the systole seemed so weak as to convey the impression of a distinct pause.

This gentleman, during a period of more than twelve months, submitted to a stringent and a regulated diet, to an alterative medical treatment, chiefly by salines and alteratives, and the nitro-muriatic acid and orange-peel tincture. Daily exercise in the open air, both on foot and pony, restored the health, and all symptoms of cardiac irregularity disappeared; sleep became natural and refreshing, the appetite returned, the digestive function was performed without flatulence or uneasiness, and the mind became cheerful, active, and self-reliant. Such is the record of a typical case of lithæmia or oxaluria, with its attendant disturbances, simulating mental and cardiac disorder, but in reality caused by functional derangement of liver, and the accumulation in the blood of the products of defective oxidation and metamorphosis.

DISEASES OF THE RENAL BLOODVESSELS.

By Frederick T. Roberts, M.D., B.Sc., F.R.C.P.

In this article it is intended to refer briefly to the chief diseases to which the renal vessels are liable; as well as to certain conditions which affect the circulation in the kidneys. At the outset, however, attention must be drawn to the fact that anatomical peculiarities involving the renal arteries may lead to more or less serious consequences. Thus a renal artery may take an abnormal course, or there may be a supernumerary trunk, and in either case the vessel may press upon or twist round the ureter, and obstruct its channel, hydronephrosis being the result.

1. Arterial Degeneration.

The renal arteries may be the seat of atheroma or calcification, these alterations being usually associated with similar changes affecting the arterial system generally, but the frequency with which they are involved has not been satisfactorily determined. The condition may only involve more or less of the main trunk, or may extend along the smaller branches. Its chief importance depends upon the fact that it is liable to lead to obstruction of the renal circulation, either in consequence of the narrowing of the calibre of the vessels, or of the occurrence of thrombosis, this being followed by degeneration and wasting of the tissues of the kidney. It is also not uncommonly associated with the granular kidney. It is quite impossible to recognize atheroma of the renal arteries clinically. Dr. Greenfield[1] has recorded two interesting cases in which this morbid condition was present. In one, a male, aged 49, along with extreme atheroma and calcification of the aorta, the right renal artery was extremely atheromatous and diminished in its calibre, its branches being also narrowed and thickened. The corresponding kidney weighed only an ounce and a half, and was firmly adherent, granular, uneven, and wasted. The left kidney weighed ten and a half ounces, but presented a depressed area, which corresponded to complete wasting of one of its lobules, due to extensive atheromatous disease and obstruction of the arterial branch supplying it. In the second case, that of a woman aged 53, who had suffered from ovarian tumor with ascites, both kidneys were very small, but the left presented degenerative changes due to plugging by coagula of the trunk of the renal artery, and of all its branches in the hilus. The wall of the renal artery close to the aorta and for about half an inch beyond was much thickened by atheroma, and narrowed.

The minute branches of the renal arteries are specially implicated in certain forms of disease to which the kidneys are liable, namely, in the granular contracted variety of Bright's disease; and in albuminoid degeneration, which commences in connection with these vessels and the Malpighian bodies. The nature of the changes is described in the several articles which treat of these conditions.

2. Aneurism.

The trunk of one of the renal arteries is in extremely rare instances the seat of

[1] Pathological Transactions, vol. xxvi. p. 135 et seq.

an aneurism, and the branches may present small dilatations of a like nature. These owe their origin to previous disease of the vessel. In most cases they are only discovered at post-mortem examinations, but they may give rise to clinical signs of their existence, namely, pain referred to the region of the kidney, which may be severe; hæmaturia from time to time, should the aneurisms be small; and a pulsating tumor. An aneurism is liable to rupture, and, should it be of any size, this event will probably lead to a rapidly fatal issue. When there is repeated hemorrhage, the passage of clots may give rise to much pain, of the nature of renal colic; or they may set up pyelitis and subsequent disease of the kidney.

3. Embolism and Thrombosis of the Renal Arteries — Hemorrhagic Infarction.

The morbid changes resulting from embolism affecting the vessels of the kidney have long been observed and described, but their real nature and origin was not recognized until within a comparatively recent period, as the result of the observations of Kirkes, Virchow, Beckman, Cohnheim, and other pathologists. They are of much greater importance from a pathological than from a clinical point of view, as renal embolism is in the large majority of instances not made out during life, either because it gives rise to no obvious clinical phenomena, or because these are but secondary and subordinate to a more serious condition of the general system or of some other organ than the kidney.

Etiology and Pathology.—Renal embolism originates in the same manner as embolism in other organs, especially the brain or spleen, namely, in consequence of particles being conveyed from the heart or great vessels, and becoming lodged in some portion of the arterial circulation of the kidney. These particles generally come from the heart, being of a fibrinous nature, and being detached either from clots in the left cavities, or from vegetations in connection with the aortic or mitral valves, resulting from endocarditis or from chronic changes. Occasionally they consist of atheromatous material detached from the aortic valves or the aorta; still more rarely an embolon originates in a fibrinous deposit within an aneurism, as in a case reported by Dr. Murchison.[1] It may also come from other parts, and may have septic properties.

Thrombosis may result from a wound of the renal artery or of one of its branches, as in a case described by v. Recklinghausen; or from arterial degeneration. It is stated that this process may also occur spontaneously, especially in certain fevers, such as typhoid fever.

Anatomical Characters. — In the main trunk or larger divisions of the renal artery, a plug, whether embolic or thrombic, may generally be recognized, but when one of the smaller branches is involved it is frequently difficult to demonstrate its presence. It is found, however, that injection driven into the trunk of the artery will not penetrate the region supplied by the obstructed vessel.

The effects of plugging in connection with the renal arteries will depend upon the size of the vessel obstructed; and on the nature of the embolon, should the blocking be due to this cause. In the first place, the main trunk of the artery may in rare instances be obstructed, and then necrosis of the kidney may follow, as in a case described by Cohnheim and Bartels, where the left renal artery was obstructed by embolism, in consequence of which the whole of the cortical portion lost its vitality, becoming pale, dull, opaque, and dry, with scattered deep bloody red spots. This is not, however, always the consequence. Wilks and Moxon[1] mention a case where Bright's disease in both kidneys was already present, and there was a most interesting reduction of the disease in the organ the vessel of which was obstructed. Another result which has been found is the development of granular disease of the kidney. When one or more of the larger branches are blocked, intense hyperæmia of the tissue surrounding the part deprived of blood is produced, followed by rupture of the Malpighian capillaries and extravasations of blood.

The usual result of the blocking of branches of either renal artery is the development of hemorrhagic infarctions in the kidney, for the formation of which the peculiar distribution of the renal vessels is specially favorable. These infarctions are almost entirely confined to the cortical portion, and they may be seen in different stages in the same organ. They vary considerably in number as well as in size, the latter ranging from that of a hemp-seed to that of a nut or even larger; and there may be a number of small infarctions in one section of the kidney, while the rest of the organ is free, in consequence of an embolon being broken up against the bifurcations of the artery into smaller particles, which pass into its finer divisions. A renal infarction is more or less wedge-shaped, though less distinctly

[1] Medico - Chirurgical Transactions, vol. xlviii. p. 129.

[1] Pathological Anatomy, 2d edit. p. 517.

so than in the case of the spleen. Its base is directed towards the surface, and projects a little beyond the surrounding level; while its apex points towards the infundibulum.

Primarily renal infarctions almost always, though, it is said, not invariably, present a hyperæmic and hemorrhagic appearance, due to intense congestion of the small vessels, with extravasation of blood into the uriniferous tubules, in consequence of some of these vessels having given way. Hence they are of a dark-red color, and may be blackish-red, especially at the centre, where the hemorrhage takes place, their edges being well defined or somewhat blurred. Rarely, however, are they seen in this their original condition, having usually undergone more or less of the following alterations, which are mainly due to changes in the extravasated or stagnated blood and in the involved tissues, which undergo degeneration together; partly to the formation of inflammatory products. As the result of these processes, an infarction loses its red color, this commencing at its centre, where it becomes gradually bright yellow or yellowish white, while at its periphery it still presents a zone of bright redness, though by degrees the change in color progresses to the circumference. This depends mainly on the alterations in the blood-pigment. The infarction also becomes rather larger, firmer, and toughish. Microscopic examination reveals at first unaltered renal tissue with blood-corpuscles; subsequently granular amorphous or fibrillated material, cellular inflammatory products, and altered epithelial cells, which undergo fatty degeneration; and, at a still later period disintegrated tubules. In some instances a further process of softening takes place, so that the central portion becomes a mere granular and fatty debris, or a purulent material may be formed. Usually in course of time the degenerated materials are gradually removed by absorption, while a growth of nucleated connective tissue takes place at the periphery, and thus a process of shrinking occurs, until ultimately nothing may be left but a firm, depressed, contracted, and puckered cicatrix, the renal tissue having been destroyed and removed, and its place being taken by connective tissue. It has been asserted that a cyst may result from a renal infarction, but Wilks and Moxon[1] state that they have never seen a cyst thus produced.

The time which is required for the completion of the changes just described is a matter of doubt; but it may be affirmed that their progress is somewhat chronic. In a case observed by Dr. Hermann Weber,[1] an infarction in the right kidney, supposed to be thirty-eight days old, was shrunk below the level of the surrounding tissue; others in the left kidney, which were believed to have occurred between a week and a fortnight later, were still slightly prominent, but had not the elevated red margin seen in still more recent cases. Usually, when there are a number of infarctions, they are seen in different stages of their progress.

When embolic particles lodge in the minute branches of the renal artery, so-called *capillary embolisms* are originated; but Cohnheim objects to this term, as the obstruction is always in the small arteries. They are observed in connection with acute endocarditis, the kidneys presenting numerous minute extravasations and infarctions in its superficial part, and they may be also seen in its interior. These capillary embolisms likewise belong to one form of pyæmia, the particles being of a septic character, and setting up severe inflammatory action, ending in suppuration or even gangrene.

It is customary to find infarctions in other organs, especially the spleen, when they are present in the kidneys.

Symptoms.—It only happens in very exceptional cases that renal embolism or thrombosis and their consequences can even be suspected during life, from the occurrence of any symptoms, and at the best these are of a most indefinite character; while in the large majority of cases there are no clinical phenomena whatever. Should a large embolon lodge in either kidney, this may be indicated by a sudden severe pain in the corresponding lumbar region, shooting down along the ureter towards the thigh. In a case diagnosed by Traube, the patient was wakened during the night by the occurrence of severe pain in the right loin, which was much increased by upward and inward pressure below the last rib, and also by movement of the trunk and coughing; but this soon passed away. The urine does not present any alterations, even when the trunk of one renal artery is obstructed. Should there be any cardiac disease or other condition present in which embolism is likely to happen, the occurrence of the kind of pain above described might possibly lead to the recognition of this event.

Treatment.—No treatment can have any direct effect upon renal embolism, but should it be suspected, the patient should be kept at rest in bed; dry heat or fomentations applied over the seat of pain; and,

[1] Pathological Anatomy, 2d edit. p. 517.

[1] Pathological Transactions, vol. xvi. p. 166.

if this is excessive, a dose of tincture of opium or some other anodyne might be given.

4. Thrombosis of the Renal Veins.

Etiology and Pathology.—The occurrence of thrombosis in connection with the renal veins may depend on *local* or *general* causes, or on the joint action of both classes; and it may arise independently, or by extension from the vena cava inferior or from the spermatic or ovarian vein on the left side. The ways in which the several causes act so as to induce thrombosis are either by compressing the renal vein or its branches, rendering the circulation feeble, or altering the constitution of the blood, so that it becomes prone to spontaneous coagulation. The chief *local* causes are: 1. Certain diseases of the kidney, namely, albuminoid degeneration, Bright's disease, and extensive cancer or other forms of tumor. 2. Severe injuries to the kidney, with consequent traumatic nephritis. 3. Neighboring tumors or enlarged organs compressing the renal vein, such as glandular growths, a retro-peritoneal tumor, a pregnant uterus, or an ovarian tumor. The *general* causes include: 1. High fever, especially if associated with previous disease of, or injury to, the kidney.[1] 2. Pyæmia and septicæmia. 3. Marasmic and cachectic conditions, such as that resulting from prolonged diarrhœa in infants, or that associated with internal cancer. In puerperal fever the occurrence of renal thrombosis is a secondary event, following uterine phlebitis, the thrombus extending from the vena cava or ovarian vein. The left kidney is more frequently the seat of this lesion than the right.

Anatomical Characters. — A recent thrombus is dark-red, soft, uniform throughout, and non-adherent to the wall of the vein. Usually, however, it is observed in a more or less altered condition, having lost its color to a variable degree, and being soft, crumbly or curdy, or else firm, organized, and adherent to or even blended with the vascular wall. The occlusion may be complete or partial, and occasionally the clot is channelled through its centre. It is variable in extent, and may reach in the one direction to the vena cava, in the other to the smallest venules that can be traced. In the latter case a section of the kidney presents a curious mottled appearance after the clots have become decolorized. The minute vessels may give way here and there, small extravasations being consequently visible. When only the trunk of the renal vein is blocked, or, it is said, even both trunks, a collateral circulation may be set up through the supra-renal veins and those of the ureters: but if the smaller branches are involved, this event cannot occur.

Symptoms.—Thrombosis of the renal vein is usually not recognized during life, and under any circumstances its diagnosis is very difficult. If the obstruction is considerable, and collateral circulation cannot be established, the results to be looked for are marked diminution in the quantity of the urine, with concentration; albuminuria; hæmaturia; and the appearance of casts in the urine. Ultimately the affected kidney ceases entirely to perform its functions. There will probably be more or less constitutional disturbance.

Treatment.—Nothing can actually be done for renal thrombosis. It is important to recognize the conditions under which it may occur, so as to take measures for its prevention.

HÆMATURIA.

By William Roberts, M.D., F.R.S., F.R.C.P.

Definition.—The term hæmaturia is employed to denote the passage of blood with the urine, whether its source be the kidneys, ureters, bladder, or urethra. It is a symptom of numerous and varied pathological conditions, of which, indeed, it is frequently the most striking phenomenon, not only to the physician, but also to the patient. The presence of

[1] See cases reported by Dr. Moxon in Guy's Hospital Reports for 1868; and in Pathological Transactions, vol. xx. p. 227, and vol. xxi. p. 248.

blood in the urine is generally easily recognized by the peculiar appearance which it imparts to the secretion; but if the quantity be very small the microscope is required for its detection. In renal hæmaturia the urine has a dull-red smoky appearance, and deposits, on standing, a brownish sediment. When the blood is derived from the ureters, bladder, or urethra, the urine has a more distinctly sanguineous hue, and little clots are often found at the bottom of the vessel.

The microscope is the surest means of discovering blood in the urine. In acid urine of normal density the corpuscles preserve their characteristic forms for several days, but if the urine be very watery or ammoniacal they disappear very speedily.

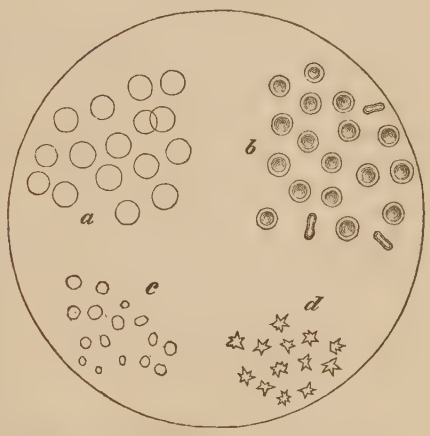
The red disks do not run into rouleaus in the urine but lie freely scattered about. Their appearance under the microscope varies a good deal according to the condition of the urine. When the urine is acid and of moderate density, they exhibit more or less of the biconcave contour and deep shading which they possess when freshly drawn from the bloodvessels. (See Fig. 86 *b*.) If the urine be very dilute the corpuscles expand into plain delicate circles without any appearance of cell-contents (*a*). Sometimes their original shape is greatly changed, they appear shrivelled, indented, or crumpled, and puckered so as to be scarcely recognizable (*c*, *d*). Blood-disks in urine are apt to be confounded with torula cells, also, but more rarely, with the minute discoid forms of oxalate of lime, and with the nuclei of renal epithelium. From the first they are distinguished by the absence of a nucleus which can always be detected by a good glass in torulæ. Oxalate of lime discoids are distinguished by the existence of intermediate forms which connect them with unmistakable dumb-bells. Renal nuclei refract the light more strongly than blood-disks, and a solution of magenta gives them a deep carbuncled-red tint, very different from the pale pink hue imparted to blood-corpuscles by the same reagent.

The chief types of hæmaturia may be grouped under the following heads:—

(*a*) *Hæmaturia from local lesions.*—By far the largest number of cases of hæmaturia come under this heading; and arise under a variety of conditions, viz., acute and chronic Bright's disease, active or passive congestion of the kidneys, violent muscular effort or straining, external injury, calculus of the kidney, ureter, or bladder, abscesses of the kidney, ureter, or bladder; cancer, tubercle, or entozoa in any portion of the urinary tract; morbid conditions of the bladder or prostate (villous disease, acute cystitis, varix of vesical veins, &c.).

(*b*) *Symptomatic hæmaturia.*—In scurvy and purpura, also in certain hemorrhagic or so-called "malignant" types of continued, eruptive, and malarial fevers, the blood assumes an unnatural fluidity, and soaks out of the bloodvessels into the uriniferous canals, and imparts to the urine a dark sanguineous character. In these cases the blood-pigment escapes in much larger quantity than the corpuscles, and gives a depth of coloration quite out of proportion to the scanty numbers of blood-disks found under the microscope.

Fig. 86.



Blood-corpuscles in urine. *a*. Slightly distended by imbibition; *b*. Showing their biconcave contour; *c*. Shrivelled; *d*. Serrated.

(*c*) *Supplementary Hæmaturia.*—In some rare cases hæmaturia is distinctly vicarious or supplementary to the menstrual discharge or a hemorrhoidal flux or a paroxysm of spasmodic asthma.

In a case of hæmaturia it is of the first importance to determine the source of the blood, that is to say, to discover whether it comes from the kidneys, the ureters, the bladder, or the urethra.

In determining whether the blood comes from the kidneys or from the bladder, we are guided partly by subjective, and partly by objective phenomena. Thus, if the kidneys are the source of the bleeding, in most cases there will be symptoms referable to these organs, viz., heat, weight, or pain on pressure in the lumbar region. There may also be pain along the course of the ureters, extending along the inner side of the thigh, or retraction of one or both testes. The blood is found uniformly diffused throughout the urine, so that the urine at the end of micturition has exactly the same characters as that voided first. Renal hemorrhage usually imparts to the urine a characteristic brownish-red or dull smoky tint. The renal origin of the blood is, of course, unequivocally proved if there be tube-casts in the de-

posit. In most cases of renal hemorrhage there is an entire absence of clots; when, however, the blood flows from the kidneys in considerable quantity, it coagulates, during its downward passage, and is moulded into long vermicular clots in the ureters. The passage of these elongated worm-like casts gives rise to symptoms identical with those produced by a calculus passing along the ureter.

If the hemorrhage comes from the bladder, there is usually pain on pressure over the pubes, and marked disturbance of the vesical functions, with pain at the neck of the bladder before or after passing water, and undue frequency or difficulty of micturition. The urine comes away at first either of its natural color or very slightly tinged with blood, while the latter portions frequently consist of pure blood, which, instead of being equally diffused through the urine, as in renal hæmaturia, is more or less clotted. These clots may impede micturition, and if retained in the bladder for any length of time may become colorless from the absorption of the blood-pigment. When the bladder is distended with blood-clots, and retention of urine is thereby produced, it is almost certain that the bladder is the source of the hemorrhage, as renal hemorrhage seldom occurs to such an extent as to cause retention.

When the blood flows either *guttatim*, or in a stream apart from micturition, it most probably comes from some part of the urethra; it should be borne in mind, however, that if the source of the bleeding is near the neck of the bladder, the blood may regurgitate into that organ and so complicate the diagnosis.

Having thus indicated generally the means whereby the source of the blood may be determined, we are in a position to consider more in detail the various kinds of hæmaturia.

Hæmaturia from external injury.—The kidneys, from their deep position in the body, are not very obnoxious to external violence, but sometimes they are injured by blows and falls on the loins and suffer lacerations, or they may be penetrated by punctured wounds. The bladder and urethra may also be ruptured by violence. In all these accidents blood may find its way into the urine. In the following case of laceration of the kidney from a fall, the writer had an opportunity of noting the condition of the urine from the time of the accident till the death of the patient five days afterwards. The patient was a bricklayer, aged 36, who, while intoxicated, had fallen from a height of seven stories, and was brought into the Manchester Royal Infirmary in a state of coma, with gasping respiration, having suffered a compound fracture of the skull. He passed no urine spontaneously after the accident, but a total of eleven ounces was withdrawn on three separate occasions by the catheter. The first specimen, obtained the day after the accident, was excessively bloody; it contained an immense number of dark granular casts evidently composed of crushed blood-clot; but there were no renal epithelial or pyelitic cells. The second specimen, obtained on the third day, was much less bloody, and contained, besides the dark granular casts, numerous deep brown casts with strongly-marked outlines and very few markings, and also a few transparent casts, some of which were studded with epithelium. In the third specimen, which was drawn just before death, and which was of a yellow color and contained no fluid blood, a considerable deposit of chocolate-colored blood granules took place; and although it was the product of forty hours' secretion, it only amounted to two ounces, with a sp. gr. of 1015. In the last two specimens free renal epithelium, browned by hæmatine, together with pelvic and infundibular epithelium, were present in abundance.

The autopsy revealed the existence of two lacerations on the posterior aspect of the right kidney, extending from the outer border almost to the hilum; they were completely closed by a firm wedge-shaped solid clot of blood, which was bleached, where it came into contact with the substance of the kidney. The adjacent renal tissue seemed perfectly healthy. The lacerations did not extend to the infundibula, but two firm blood-concretions, one as large as a horse-bean, and the other the size of a pea, lay loose in the pelvis, with several smaller ones in the infundibula. No signs of inflammation were found in the brain or peritoneum. Death was evidently due, in this case, to suppression of urine.

Hæmaturia from violent muscular effort or straining.—Any great exertion, as in leaping, inordinate equestrian or pedestrian exercise, wrestling, and the like, may give rise to hæmaturia from engorgement of the renal vessels, and subsequent rupture of the vessels of the Malpighian tufts, or from rupture of congested vessels about the neck of the bladder. A case is cited by Dr. Beale in which hæmaturia occurred day after day in a healthy man just at the close of micturition, probably from the rupture of a few capillaries about the neck of the bladder consequent upon the effort to expel the last drops of urine. This disappeared after a time without any special treatment.

Hæmaturia from calculus in the kidney, ureter, or bladder.—This is a common cause of bloody urine. The position occupied by a calculus in the kidney influences to a considerable extent the amount of the bleeding. Thus so long as it re-

mains where it was formed, there may be no symptoms leading to a suspicion of its presence, but immediately dislodgment has taken place, sudden pain sets in accompanied by more or less hemorrhage. There is no direct proportion between the amount of hemorrhage and the size and number of the calculi.

When minute calculous concretions are formed within the tubuli uriniferi, they sometimes give rise to hæmaturia coming on again and again, unaccompanied by any pain or discomfort save a slight aching or sense of fatigue in the lumbar region. On a careful examination of the urinary deposit, microscopic calculi of oxalate of lime or uric acid may be detected, with fibrinous casts dotted over with crystalline molecules, and there is more albumen in the urine than can be accounted for by the amount of blood passed.

Hæmaturia frequently takes place from the pelvis of the kidney or from the ureter, as a result of the passage of a calculus. When such is the case, there will be symptoms of pyelitis and nephritic colic. The blood, issuing from the pelvis, as a matter of course is not moulded in the renal tubes; it should be remembered, however, that clots may be formed in the infundibula or ureter, which may, in passing along the ureter, give rise to precisely the same symptoms as a calculus.

When vesical hæmaturia is caused by a calculus, the bleeding is usually inconsiderable; there are well-marked symptoms of vesical irritation, and the use of the sound will generally settle the diagnosis. When calculus is the supposed cause of hæmaturia, the occurrence of a gravelly or crystalline sediment along with the blood would yield presumptive evidence in favor of this being the case. It is not to be considered conclusive, however, unless no other cause of hemorrhage can be discovered. Dr. G. Johnson cites the case of a man who had hæmaturia as the undoubted result of the administration of half an ounce of turpentine for tapeworm, in whose urine blood-casts were detected studded with crystals of oxalate of lime.

In *hæmaturia from abscess, renal tubercle, embolism, and entozoa*, the quantity of blood is rarely abundant; the subject is treated of at greater length in the sections devoted to these affections respectively.

Hæmaturia from cancer of the kidney.—As a rule the hemorrhage in renal cancer is irregularly intermittent and profuse, occasionally causing rapid anæmia and exhaustion; sometimes it is so trifling in amount that it cannot be detected without the aid of the microscope, and in more than half the cases it is altogether absent. In some cases it recurs at irregular intervals without any apparent cause, although its onset can occasionally be traced to some blow or fall. In two cases of hæmaturia from renal cancer under the observation of the writer, the presence of cancer-cells could not be discovered after repeated and careful examination. There is almost always a distinct renal tumor present in the anterior lumbar and hypochondriac regions which materially aids the diagnosis.

Renal congestion, active or passive, may give rise to hæmaturia. Cases of this class will be considered more fully in the articles on congestion of the kidneys.

Hæmaturia from Bright's disease rarely takes place to an alarming extent. It is of most frequent occurrence in the earlier stages of the acute form, and the urine then contains, in addition to blood-corpuscles, abundance of tube-casts and renal epithelium. In the chronic forms still more than in the acute, copious hæmaturia is very rare. In these cases casts of various kinds will be found associated with the blood corpuscles, so as to leave little room for doubt as to the origin and cause of the hemorrhage. The article on Bright's disease will contain further details on this head.

Morbid conditions of the bladder or prostate may give rise to the escape of large quantities of blood with the urine. The most common of these are cancer, villous disease, acute cystitis, and a varicose condition of the veins of the mucous membrane of the bladder. It should be borne in mind, too, that retention of urine in the bladder, whether arising from paralysis or from its not being fully evacuated by natural efforts, as in certain cases of stricture, may give rise to hæmaturia from decomposition of urea and generation of carbonate of ammonia which acts as an irritant.

Mental emotion has, in a very few recorded cases, been apparently the cause of hæmaturia. Thus Rayer mentions a case in which a fit of passion was followed by hæmaturia, and Dr. Basham[1] cites the case of a shoemaker who had frequently recurring attacks of hemorrhage from the kidneys on each occasion of the misconduct of a drunken wife.

Supplementary Hæmaturia.—The cases included under this head are those remarkable instances where hæmaturia seems to take the place of some natural or morbid condition. Several cases are on record where a periodic discharge of blood with the urine seemed to be substituted for the menstrual flow. Chopart cites the curious case of a soldier, aged 19, who had a monthly discharge of bloody urine accompanied by all the symptoms characteristic of the menstrual flux. Rayer mentions two similar cases, one of which

[1] Basham on Dropsy, 3d edit. p. 312.

was that of a butcher of Sedan, whose infirmity becoming known inspired so great disgust that no one would purchase meat from him. Chopart and Latour relate cases where a hemorrhoidal flux was supplemented by hæmaturia; and the latter writer relates a case of spasmodic asthma which had proved so obstinate and severe that the patient had been unable to lie in bed for eighteen months, but which suddenly disappeared on the supervention of hæmaturia.

Prognosis.—This depends upon (*a*) the amount and duration of the hemorrhage; (*b*) the nature of the condition giving rise to it; and (*c*) the probable consequences of the hemorrhage.

Hæmaturia is rarely fatal from the mere loss of blood, so that a favorable prognosis may generally be given *quoad* the hemorrhage; indeed, in many cases, the occurrence of hæmaturia is a salutary process giving relief to the renal vessels when in a state of hyperæmia.

The prognosis of hæmaturia is frequently merely the prognosis of the affection causing it, and will be favorable or unfavorable according to the nature of this affection.

The remoter *consequences* of hæmaturia are not unfrequently a source of danger. Blood effused into the uriniferous tubules coagulates and forms a series of plugs occupying their entire calibre; and unless these coagula are expelled by the pressure of the urine from behind, they continue to block up the tubes and thereby permanently destroy the function of the corresponding parts of the gland, and lay the foundation of a fatal renal degeneration.

Another occasionally untoward consequence of hæmaturia is the formation from the clot of a nucleus round which calculous concretions may form, so that hæmaturia may be the cause, as well as the consequence, of a calculous formation.

Treatment.—This obviously depends upon the cause, degree, and source of the hemorrhage. When the cause and source are known, the treatment of the hæmaturia will be the treatment of its cause. Sometimes, however, cases occur in which we are unable to discover the cause, and the hemorrhage is sometimes so excessive that direct attempts to check it must be made even although the cause be irremovable.

When hæmaturia is symptomatic of hyperæmia of the kidneys, such as that produced by acute Bright's disease, by overdoses of turpentine and cantharides, by external injuries or muscular efforts, it should not be interfered with unless it prove excessive, remembering that in such conditions a moderate bleeding is rather favorable than otherwise, as it relieves the congested vessels. Should it prove excessive, however, the best means of arresting it are rest in bed, and the diligent use of derivative measures, viz., the abstraction of blood by cupping over the loins, the promotion of free cutaneous transpiration by means of warm baths and diaphoretics, and the administration of hydragogue cathartics.

Passive hæmaturia occurring *in the course* of zymotic diseases should be carefully discriminated from acute Bright's disease occurring as a *sequela* of these affections. The former depends upon a general hemorrhagic tendency, and the bleeding probably takes place from the whole urinary tract and not merely from the kidneys. The treatment ought to be constitutional, at least at first, and the remedies most efficacious in this class of cases are the mineral acids, especially sulphuric acid, freely administered. Where passive hæmaturia takes place from the bladder, copaiba and turpentine have been recommended; cautiously administered they are said to prove of service sometimes when other remedies fail. (Hassall.)

When hæmaturia is supplementary to hemorrhoidal discharges, provided the blood be shed from the mucous membrane of the bladder and not from the substance of the kidney, it should not be looked upon as unfavorable, nor be rashly interfered with; should it become necessary, however, the application of a few leeches in the neighborhood of the anus will give great relief. Where hæmaturia takes the place of the menstrual flow, it should be suppressed only on the re-establishment of the normal function.

In many cases of hæmaturia, however, we are called upon to treat it for itself, its cause being irremediable, as in cases of cancer of the kidney and bladder, villous disease, and the like. The two first indications in the treatment of such cases are the enforcement of perfect rest, and the application of cold to the bleeding part in the most effectual manner. Thus if the kidneys be the source of the blood, ice-poultices should be applied to the loins; if the bladder, iced water injections may be thrown into the bladder, and iced cloths applied to the perinæum and epigastrium.

Hæmostatics should also be employed; one of the most valuable of these is gallic acid, which may be given in five grain doses, frequently repeated. Dr. Golding Bird speaks highly of acetate of lead given frequently and in large doses for short periods. He recommends three or four grains, with one-fourth of a grain of opium in a pill every two hours, until six or eight doses have been administered, care being taken to keep the bowels open by saline purgatives. Ergot of rye has

also been found of much service, and, judging from the successful results of the hypodermic injection of ergotin in pulmonary hemorrhages,[1] this method seems worthy of trial in hæmaturia. A solution of three to five grains of ergotin in ten minims of distilled water, or in five minims each of glycerine and rectified spirit, may be employed. Another valuable remedy is the tincture of the muriate of iron, which should be given in large doses frequently repeated. Dr. Johnson remarks: "This medicine arrests hæmaturia by a different process in different cases. Sometimes it has a directly astringent effect upon the bleeding vessels; but in other instances it acts by correcting the alkaline condition of the urine, which by its irritant action upon the bladder has excited the hemorrhage." Alum, turpentine, and matico have also been found of service; turpentine should be cautiously administered on account of its irritating properties: its use is attended with less risk when the hemorrhage is vesical than when it is of renal origin. Dr. Prout observes: "When the bladder becomes distended with blood, and complete retention of urine in consequence takes place, recourse must be had to a large-eyed catheter and an exhausting syringe, by the aid of which, and the occasional injection of cold water, the coagula may be broken up and removed. If the hemorrhage be so profuse that the bladder becomes again distended with blood in a very short time, the injection of cold water into the rectum or bladder is sometimes of great use; and should these means fail, from twenty to forty grains of alum may be dissolved in each pint of water injected into the bladder, a remedy that seldom fails to check the bleeding even when the cause is malignant disease. I have never known any unpleasant consequences follow the use of this expedient, and have seen it immediately arrest the most formidable hemorrhage when all other means had failed, and when the bladder had repeatedly become again distended with blood almost immediately after its removal."

ENDEMIC HÆMATURIA.

By William Roberts, M.D., F.R.S., F.R.C.P.

Definition. — A peculiar form of hæmaturia indigenous to the Mauritius, Egypt, the Cape of Good Hope, Brazil, and other hot countries, associated with, and apparently due to, the presence of a minute parasite (Bilharzia hæmatobia), which infests the minute veins of the pelvis of the kidney, ureter, and bladder.

History.—This variety of hæmaturia seems to have been first recognized by Chapotin in 1812, as an affection endemic to the Isle of France. He has recorded several cases,[2] as have also Salesse,[3] Rayer,[4] and Dr. Todd.[5] The real nature of the complaint remained unsuspected until the discovery of the offending entozoon, by Dr. Bilharz, while engaged, conjointly with Griesinger, in investigating the diseases of Egypt.[1] It is, however, mainly by the researches of Dr. John Harley[2] on the endemic hæmaturia of the Cape of Good Hope, that the parasitic origin of that, and most probably of the endemic hæmaturia of all other hot countries, has been fully established.

Pathology and Symptomatology. —The entozoon discovered by Bilharz was named by him distoma hæmatobium; subsequent investigations, however, established the presence of a gynœcophoric canal which renders it generically distinct from the distomata. Diesing named it gynœcophorus hæmatobius; but the name by which it is most familiarly known is that given to it by Cobbold in honor of its discoverer, Bilharzia hæmatobia. It is a white, elongated, soft-skinned, bisexual entozoon, three or four lines in length,

[1] Dr. Ritchie, Practitioner, vol. vii. 1871, p. 321.

[2] Topographie Médicale de l'Ile de France. Paris, 1812.

[3] Sur l'hématurie, ou Pissement de Sang. Paris, 1834.

[4] Maladies des Reins, vol. iii.

[5] Clin. Lects. on Urinary Diseases, 1857, p. 62.

[1] Bilharz, Zeitschr. f. wissensch. Zoologie, Bd. iv. Griesinger, Beobachtungen über die Krankheiten v. Egypten. (Arch. d. phys. Heilkunde, 1854, p. 561.)

[2] Med.-Chir. Trans. vols. xlvii. lii. and liv.

and belongs to the trematode order of worms.

The body of the male is comparatively thick and short, and is provided on its ventral aspect with a furrowed canal (canalis gynœcophorus) for the reception of the longer delicate filiform female during congress. The ovisac dehisces longitudinally; the eggs are about $\frac{1}{170}$th of an inch long, and are oval with an anterior terminal spiny projection. The newly-escaped embryo is flask-shaped and covered with cilia—by the aid of which it moves rapidly about.

The first specimens were found by Bilharz in the portal vein and its branches and in the walls of the urinary bladder. The entire trunk of the portal vein is sometimes filled with it, the hepatic tissue containing numerous ova. The parasite does not, however, produce much derangement in the larger vessels. In the intestine, it is frequently associated with a disease resembling dysentery, giving rise to congestion and extravasation of blood, and frequently also to exudations on the free surface of the mucous membrane. The egg-shells have been found in the blood of the left ventricle. It is when lodged in the smaller vessels of the mucous and submucous tissue of the urinary tract, that the most pernicious effects of the parasite are seen. The bladder is chiefly affected; here it gives rise to injected and ecchymotic raised patches, varying from the size of a lentil to that of a shilling, covered with tough mucus or with grayish-yellow bloody exudation, containing masses of ova. At a later stage, the patches are more prominent and are mixed with minute specks of pigment; they may be smooth and leathery, or soft, friable, and covered with gravelly incrustations consisting of uric acid and other urinary deposits mixed with ova and blood. In some cases, the submucous tissue only seems involved, and the patches look like nodules or condylomata; in other instances, the mucous membrane may be thickened, injected, adherent, or detached. When the ravages of the entozoon extend to the ureter and pelvis of the kidney, still more dangerous consequences ensue. The thickening of the submucous tissue produces diminution of the calibre of the ureter. Above the constriction, dilatation of the ureter takes place in consequence of accumulation of urine, and a hydronephrotic condition is produced by the subsequent distension of the pelvis. In some cases inflammation and suppuration are set up and severe pyelitis supervenes, or renal disorganization and atrophy may ensue, as in a case observed by Griesinger in which the whole renal structure was destroyed, and the kidney had been converted into an enormous sac filled with pus.

Besides these direct results, masses of the parasitic ova are prone to become coated with urinary concretions, and thus to form the nuclei of large calculi; and it seems not improbable that septic infection may be produced by the accumulation of dead and dying animals in the portal vessels. Moreover, they may creep into the general circulation and find their way into organs of vital importance. It is believed that pneumonia may thus be produced.

Symptoms.—The first indications of the disease are the passage of a little dark-colored blood after emptying the bladder of clear urine. The quantity of blood is increased after unusual exercise or travelling. At intervals, somewhat soft cylindrical filaments are passed usually stained with blood; sometimes they are nearly colorless. These red threads occasionally block up the urethra, and cause obstruction to the flow of urine. The quantity of urine voided is natural; occasionally a sudden sharp twinge of pain is experienced in the loins, which as suddenly subsides, sometimes a tickling sensation in the hinder part of the urethra is felt. Active exercise, such as riding, gives rise to pain in the back and perineum. As a rule, the general health is good; a feeling of lassitude is not uncommon, a cachectic or anæmic condition is sometimes met with.

The following case which fell under my notice in the Manchester Infirmary illustrates the main features of the disease as it is sometimes encountered in this country.

William Ray, aged 19, was admitted into the Manchester Infirmary under my colleague Dr. Simpson, in February, 1871. He stated that rather more than two years ago he went to Cairo, as groom, in the service of the Viceroy of Egypt. After a stay of some months, he went to Alexandria for the summer, returning to Cairo in the winter. He returned to this country about four months ago. While in Egypt he had been in the habit of drinking the water of the Nile unfiltered, and of eating water-cresses freely; with one or two exceptions, he invariably rode horses barebacked. About four months after his arrival in Cairo, he observed that he passed bloody-looking urine, and shortly afterwards he suffered pain in the back and perineum when riding. Since then he has persistently passed turbid urine containing blood. He is now very anæmic and thin, but in fair health apart from the urinary affection. On the 10th of March I examined the patient's urine. The specimen was a fair sample of what he generally passed. It was smoky and

turbid, with an abundant reddish-white deposit in which might be seen little flakes of blood-clots; it was neutral to test-paper, sp. gr. 1010, and contained a little albumen — rather more than the blood and pus would account for. Under the microscope, the deposit was seen to consist mainly of pus, mixed, however, with blood, both in the form of shreddy clots and as free corpuscles. Both free embryos and unhatched ova of the Bilharzia hæmatobia were present in considerable numbers (*see* Fig.). The embryos, in the mature ova, exhibited slow expanding and contracting as well as oscillating movements; these expansile movements were especially seen in the cervical narrowing, which at one time became very marked, and anon was almost effaced. The free embryos (1) moved actively in the urine for some hours after its emission. They were covered all over, with the exception of the head, with long vibrating cilia, by means of which they moved in various directions, with intervals of quiescence. At times an embryo could be seen racing across the field of the microscope with such speed that the eye could scarcely follow it—at other times, the movement consisted in stretching out the body to its full length, and then retracting it to an oval or ball-shape. When moving across the field, the body turned over and over on its longitudinal axis. Sometimes the

Fig. 87.

Bilharzia in the urine of Wm. Ray. 1. Free embryos—showing the different shapes they assume as they swim about in the urine. 2. Ova containing unhatched embryos. 3. Empty shells from which the ova have escaped.

head was retracted into the interior of the body. A number of empty eggshells, with irregular openings in them, or in fragments, were also seen scattered over the field (3).

This patient continued under observation for nearly three weeks, and then left the hospital without leave.

In this case all the ova had terminal spines—not lateral ones—so that they resembled exactly the ova found by Harley in the cases from South Africa. Dr. Harley states that in his cases he never met with a free living embryo in the urine. "Eggs, which split open and liberate active embryos immediately after they are placed in water, remain quiescent for an indefinite time when left in the urine, and all my attempts to hatch them in this fluid kept fresh and warm have invariably failed" (Med. Chir. Trans., vol. liv.). In the case just recorded this was certainly not the case—the embryos moved actively in the urine for several hours after its emission.

Etiological Considerations. — There can no longer be any reasonable doubt that the presence of this parasite in the urinary tract is the cause of these endemic forms of hæmaturia, but as to the precise manner in which it effects an entrance into the body there is still room for additional research. It seems probable that the most usual channel is the stomach, the ova or embryos of the parasite being swallowed in infected water or along with salad or vegetables. Dr. Harley suggests that it sometimes obtains admission through the skin—that the minute leech-like animal attaches itself to the skin of a person while bathing or wading, and implants its ova in some superficial vein. If such be the case, it is easy to understand that the hatching process and irritation attending the movements of the free embryos would result in an indolent form of ulceration, and that the little animals might be carried by the circulation from the limbs to the urinary organs. It is certain that new colonists in the Cape

are prone to be affected, during the first year or two of their residence, with indolent sores on the legs, and it seems not unlikely that their origin may be thus accounted for.

There are a few other particulars relating to the etiology which call for remark. Endemic hæmaturia may occur at any age; but is most prevalent during childhood and young adult life. It seldom occurs under five or six years of age. Dr. Harley cites a case in a man of seventy-six. Different countries appear to be differently affected by it, in regard to the sexes. Thus Chapotin observes, "In the Isle of France, children of both sexes are affected from the tenderest age with hæmaturia;" while Dr. Rubidge of Port Elizabeth, writing to Dr. Harley, remarks, "Females are rarely affected, if at all. I have not myself observed a single well-marked case in this sex;" and Dr. Johnston says, "Hæmaturia prevails to some extent among the children of the civil community of Natal, and attacks both sexes, but boys more frequently than girls."

The disease seems incommunicable from husband to wife, as the wife of a patient of Dr. Harley had three or four healthy young children, and the husband had been passing numbers of the parasitic ova every day of their married life—yet the lady had never had the slightest symptom of the parasitic disease, and her urine was free from all traces of the parasite.

With regard to the distribution of the disease, it seems to be by far the most common in Egypt, where Griesinger found the parasite in 117 out of 363 autopsies performed by him. It is endemic in Natal, where it seems restricted to certain localities near the coast, the elevated regions of the interior remaining free from the parasite. In the Cape Colony, it appears to be limited to Port Elizabeth and Uitenhage.

Prophylaxis.—This is a matter of great importance to the communities among whom the parasite is found, and it is suggested by our knowledge of the cause of the disease. From the researches of Siebold on the trematode worms, it may be assumed that between the ciliated embryo above described, and the adult sexual worm, there are two other distinct forms which serve to complete the chain of metamorphoses connecting these two extremes of development. Fresh-water mollusca and fish are probably the victims selected by the parasite during its development through these intermediate stages. Harley on these grounds suggests the following prophylactic measures in districts affected with endemic hæmaturia: 1. The water used in drinking should be conveyed from its source to its destination in covered channels, so that the ova contained in the excreta of those infested with the parasite may be prevented from mixing with it. 2. Drinking water should be filtered. 3. Salads which may entangle small mollusca containing parasites, and uncooked molluscs and fish (as smoked fish) should be carefully avoided.

Prognosis.—This affection is rarely fatal in itself. In the case of children it seems to disappear gradually about the age of puberty, and apparently to entail no subsequent complications. Harley, however, remarks that although the hæmaturia ceases, the parasite probably remains and may give rise to an entirely new set of symptoms. Thus in one case under his notice hæmaturia had ceased for more than a year, and the patient believed himself perfectly free from any urinary or renal disorder, when he voided a small calculus. In another case, ten years after the disappearance of hæmaturia, calculi were passed at intervals, containing the ova of the parasite.

Treatment.—The remedies for ordinary hæmaturia have been tried in the endemic form without the slightest effect. They were given empirically with the view of checking the leading symptom. The rational treatment is to remove the cause, and in endeavoring to do this our efforts should aim at either killing or expelling the adult parasite, or, if this be impracticable, at securing the regular expulsion of the ova, which, so long as they remain inmates of the economy, are prone to become the nuclei of urinary calculi. Dr. Harley found that a draught composed of fifteen minims each of oil of turpentine and male fern, with five minims of chloroform in two ounces of tragacanth mixture given every morning, brought away great numbers of the ova; he relieved the renal irritation and pain due to the presence of crystalline concretions by giving the bicarbonate of potash in copious draughts of water. By this means the disintegration of calculi is facilitated and their formation prevented, as the uric acid, which he regards as the cementing medium of the deposits, is dissolved by the alkali.

When the bladder and prostate alone appear to be affected, we may have recourse to topical medication of the bladder. Dr. Harley tried the effects of injections of various substances into the bladder in the form of solution or emulsion. These were chiefly quassia, wormwood, oil of male fern, and iodide of potassium. The latter was the only substance which yielded satisfactory results. He recommends a solution of twenty to thirty grains of the iodide in five ounces of tepid water to be injected every second

or third day, having found in a case reported by him that this "topical treatment was effectual in clearing away the accumulated products of the parasite, in securing their expulsion as fast as they were formed, and ultimately in destroying the adult parasite."

HÆMATINURIA AND PAROXYSMAL HÆMATINURIA.

By William Roberts, M.D., F.R.S., F.R.C.P.

Hæmatinuria.

Definition.—The passage of hæmatin, or the coloring matter of the blood, with the urine unaccompanied by rupture of the capillaries and the presence of blood-corpuscles.

Synonym.—False hæmaturia.

Pathology.—The urine is of a deep reddish brown or brownish black color, looking very much as if it contained blood, but the most careful microscopical examination fails to reveal the presence of blood-corpuscles, or of fibrin. It always contains albumen, and coagulates on boiling. Vogel gives the following explanation of the appearance of free hæmatin in the urine. By the decomposition of blood-corpuscles which is constantly taking place in the body during the normal nutritive changes, hæmatin is set free, and after subsequent metamorphoses, is probably excreted in the form of urinary and biliary pigment, so that in health hæmatin never directly passes into the urine. But in certain diseased conditions, excessive disintegration of the red blood discs takes place, and the quantity of hæmatin thereby set free is too large to undergo the normal changes, and a portion of it is therefore excreted unchanged in the urine. This rapid destruction of red-corpuscles occurs in affections associated with a so-called "dissolved state of the blood," in septic, pyæmic, and putrid fevers, in some extreme cases of scurvy and purpura, and a temporary, but most marked, hæmatinuric condition is produced by the inhalation of arseniuretted hydrogen. Vogel relates a case in which the urine was of an inky blackness for about twenty-four hours after the inhalation of arseniuretted hydrogen during a chemical experiment. He has further shown by experiment that the same condition may be produced artificially in animals by causing them to inhale arseniuretted hydrogen and also carbonic acid, and by the injection into the veins of substances known to produce disintegration of the blood-corpuscles.

The existence of hæmatinuria indicates an excessive decomposition of blood-corpuscles; it admits of a favorable prognosis if the cause be of a transient nature; should it appear in the course of scorbutic or septicæmic conditions, however, it must be looked upon as a sign of great danger to the patient.

Paroxysmal Hæmatinuria.

Definition.—A disorder occurring in paroxysms characterized by the sudden onset of a feeling of cold or shivering, generally after some exposure, accompanied by a dull sense of weight or pain in the lumbar region, and terminating, after an interval varying from half an hour to two hours, with the discharge of very dark bloody-looking urine, in which, however, no blood corpuscles can be detected. The urine at the next micturition or the one after is found to present its normal appearance. These paroxysms recur at irregular intervals, and are never followed by a hot or sweating stage.

Synonyms.—Intermittent Hæmaturia (Harley); Winter Hæmaturia (Hassall); Intermittent Hæmatinuria (Gull); Paroxysmal Hæmaturia (Pavy); Intermittent Cruenturesis (Thudichum).

History.—This curious affection seems to have escaped recognition up till a very recent period. Rayer, in his comprehensive treatise on diseases of the kidneys, cites three cases which resemble in some particulars the affection under consideration; none of these cases came under his own observation, however, and it is doubtful, in the absence of chemical and microscopic examination of the urine, whether they really were cases of paroxysmal hæmatinuria.

We are indebted to Dr. George Harley[1] for the first description of this disorder.[2] He published two cases which had come under his observation; he was followed very shortly afterwards by Dr. Dickinson,[3] who related the particulars of four cases. Cases have been subsequently published by Gull,[4] Murchison,[5] Pavy,[6] Greenhow,[7] Hassall,[8] Habershon,[9] and others.

The present writer has collated these cases, to which he has added three others, two of which were under his own observation and one under that of Dr. Ritchie; from an analysis of these twenty cases in all, the following account is drawn up.

Clinical History.—The symptoms of a typical case of paroxysmal hæmatinuria are as follows: An individual is exposed to cold, or to damp and cold conjoined; he suddenly experiences a feeling of coldness of the extremities, and this is followed by general chilliness, passing into distinct rigors, accompanied by a feeling of malaise, a disposition to stretch himself and to yawn. An uneasy sense of weight, or a dull heavy pain is felt in the loins, extending round to the umbilicus and passing down the thighs; there is pain or a feeling of weakness or stiffness in the lower extremities, nausea, and, perhaps, vomiting. There may be retraction of the testicles. About an hour or a little more from the commencement of the paroxysm, a quantity of dark porter-like urine is passed, after which the pain and general disturbance subside, leaving the patient apparently perfectly well until the next paroxysm. Each paroxysm lasts from three to twelve hours, and it is worthy of notice that no paroxysms occur at night, the urine voided before breakfast being invariably natural. The recurrence of the paroxysms in different cases, is most variable. In some instances, they recur once, twice, or even thrice a day; more commonly they recur on alternate days, or twice a week, or once in ten days, or quite irregularly. They may recur in this way with more or less regularity during a period of a few days, or five or six weeks, and then cease altogether for a few days, or for weeks or months, and recur again in a similar manner. The disorder may thus continue an interrupted course for many months or years; in one case cited by Dr. Dickinson, the paroxysms had recurred at varying intervals during eleven years. After the disease is established the subsequent paroxysms are usually (but not always) quite unconnected with a fresh exposure to cold or damp.

Characters of the Urine.—The color of the urine resembles that of porter or of the darkest port wine; it is generally turbid, and deposits, on standing, an abundant chocolate-colored sediment. The specific gravity varies from 1015 to 1033, usually ranging between 1022 and 1025; the reaction is usually acid, but it may be faintly alkaline. It is always highly albuminous, and on boiling, the albumen coagulates into brownish masses, which on subsiding leave the clear supernatant urine of nearly its original dark red color. Increased elimination of urea takes place during the paroxysms; in one of Dr. Harley's cases, the amount of urea in a specimen of urine passed during the paroxysm was 3·6 per cent., and the next urine passed after the paroxysm only contained 1·8 per cent. In a case observed by Dr. Dickinson, the urea reached 4·8 per cent., whilst in a specimen examined by the writer, it amounted to so much as 5·2 per cent.

The chocolate-colored sediment, when examined microscopically, is found to consist chiefly of amorphous granular matter, which is presumably the product of disintegrated blood corpuscles. There are also present a few casts of tubes, some of which are transparent and fibrinous, but they are mostly of dark granular appearance. Crystals of oxalate of lime are generally seen, and occasionally amorphous urates are present; *very rarely indeed* a few stray blood-disks. Sir William Gull found myriads of minute crystals of hæmatine having a brilliant red color.

The change in the urine may take place with the utmost abruptness, that passed at one micturition being porter-like, and possessing the characters just enumerated, and at the next, straw-colored, free from albumen, and in every respect normal; or it may change more gradually, resuming its normal appearance at the fourth or fifth micturition after the paroxysm.

The State of the General Health.—In most cases the patient is sallow and pale;[1] sometimes hepatic derangement has been present when the patient came under observation. Of the twenty cases collected, four had at some time suffered from ague; but in the remainder there

[1] Med.-Chir. Trans. vol. xlviii. p. 161.

[2] Dr. Wickham Legg has directed attention to the fact that Dessler, in 1854, published a full account of this disorder in Virchow's Archiv for that year. See Dr. Legg's paper, St. Barthol. Hosp. Rep. vol. x.

[3] Ibid. p. 175.

[4] Guy's Hosp. Rep. 3d series, vol. xii. p. 381.

[5] Path. Soc. Trans. vol. xvi. p. 183.

[6] Ibid. vol. xviii. p. 157.

[7] Clin. Soc. Trans. vol. i. p. 40; and Edin. Med. Journ. vol. xiii. p. 996.

[8] Lancet, 1865, vol. ii. p. 369.

[9] Ibid. 1870, vol. i. p. 158.

[1] In one case, reported by Dr. Dickinson, the patient had the appearance of robust health the day before an attack came on.

was no evidence or suspicion of ague or exposure to paludal influences. Many of the cases seem to have the rheumatic diathesis, and in one case under the observation of the writer, subacute rheumatism set in with swelling and pain in the joints after the cessation of the paroxysms. Bronchitis and asthma have been concomitants in one or two cases.

Prognosis.—This is generally good. Of the twenty collated cases none died; twelve were reported as having completely recovered, one was convalescent, and seven were in progress at the time they were reported. By complete recovery is understood that the paroxysms did not recur for a period varying from six weeks to four years; it ought, however, to be borne in mind that a relapse may take place after several months—in one case the paroxysms recurred in five months, and in another, two years after, they had entirely ceased.

Etiological and Pathological Considerations.—The liability to this affection seems to be almost exclusively confined to males, as out of the twenty collected cases only one occurred in a female. The *age* of the patient at the time of the invasion ranged between two years and forty-eight; two cases occurring under twenty, seven between twenty and thirty, six between thirty and forty, two between forty and fifty; in three instances the date of invasion is not specified.

The *exciting cause* was distinctly connected with malarial poisoning in two cases; in all the others, with one exception, the disorder was clearly attributable to vicissitudes of temperature or exposure to damp. The effects of exposure to cold are well exemplified in a case of Dr. Johnson's, in which the patient, so long as he remained in bed, continued free from the paroxysms; but if he sat up and got chilled a paroxysm came on; in a case mentioned by Dr. Pavy, the patient sometimes averted an attack by going indoors directly he felt it coming on, and sitting before the fire and drinking something warm. Sir William Gull believes a blow or injury to the loins may produce this disorder, and cites the case of a young lady who fell on her back in getting into a railway carriage, and passed, shortly afterwards, dark bloody-looking urine, which contained "only the granular pigment matter of disintegrated blood-corpuscles." In the absence of further evidence, however, we must hesitate to accept such injuries as a cause of *paroxysmal* hæmaturia.

The *pathology* of the affection is at present very obscure; it seems clear, however, that the kidneys are affected, the symptoms indicating a sudden transitory congestion of the renal capillaries with escape of their contents, *without rupture of their walls*. We may infer that this is produced through the medium of the nervous system, from the paroxysmal nature of the disorder and the nervous phenomena which characterize its onset, *viz.*, the rigors, nausea, and malaise. There seems to be some hitherto unknown connection between this disorder and ague; but, though related, they are not identical, for in by far the greater number of the recorded cases, there was no aguish tendency nor evidence of exposure to malaria. Besides, there are important differences in the course of the two affections: thus, so far as the temperature has been observed in paroxysmal hæmatinuria during the initial stage, it has been, unlike what obtains in the cold stage of ague, considerably lower than normal; moreover, no distinct hot or sweating stages, and no constant periodicity are observed in the hæmatinuric paroxysms.

Treatment. — The remedies appropriate to hæmaturia are perfectly inefficacious in this affection. In two of the recorded cases the attacks seem to have passed off without medicinal treatment, simply by avoiding exposure to cold; in a case observed by the writer, the paroxysms gradually subsided under the use of a pill containing one grain each of quinine and sulphate of iron. In one of Dr. Dickinson's cases, cupping over the loins, vapor baths, gallic acid, quinine, and iron in various forms, were tried in succession, but nothing seemed to affect the disorder: "the hemorrhage always ceased on the removal of the cold which caused it." Dr. Harley gave mercurials, and afterwards quinine, in his cases, with marked benefit, one patient having remained free from the paroxysms for four years during which he was under observation. Sir W. W. Gull gave two-drachm doses of compound tincture of cinchona three times a day with benefit; and Dr. Hassall found that the hemorrhage was considerably restrained by giving, night and morning, a powder containing tannic and gallic acids and burnt alum, with a mixture containing quinine, sulphate of iron, and excess of sulphuric acid during the day. Dr. Habershon found that quinine and arsenic, and Dr. Greenhow that quinine and perchloride of iron, and afterwards quinine and syrup of the iodide of iron with iodide of potassium, had the effect of causing the urinary symptoms to subside, and the patients remained free for several months afterwards during the time they were under observation. Dr. Beale[1] calls attention to the importance of giving

[1] Practitioner, vol. i. 1868, p. 73.

quinine in full doses, not less than six grains, in order to combat the disorder successfully. During the paroxysm, Dr. Ritchie found the best treatment was to send the patient to bed, apply artificial heat, and administer warm stimulating drinks, such as hot brandy and water.

The evidence generally is strongly in favor of quinine and iron as the most effective medicinal agents.

ALBUMINURIA.

By William Roberts, M.D., F.R.S., F.R.C.P.

Normal urine may be said to be entirely free from albumen. In certain cases, however, albumen has been observed temporarily in the urine of apparently healthy persons. This may be due to dietetic errors, as in the case of Barreswil, who passed albuminous urine for twenty-four hours after eating ten eggs;[1] or it may be due to dyspepsia, as in the case of Beneke,[2] who four times during so many weeks detected albumen in his own urine while suffering from dyspepsia. Eleven years after, he remained perfectly free from indications of renal disease.

The presence of albumen in the urine is not so invariably associated with kidney disease as was once supposed; but is caused by a variety of conditions, a correct appreciation of which is essential to a proper understanding of its pathological import. As albumen is the most common and the most important of the abnormal ingredients found in urine, it is obviously necessary that its presence should be looked for in every specimen of pathological urine.

Tests for Albumen.—The practical tests for albumen are coagulation by heat or by nitric acid; in doubtful cases it is necessary to combine these two tests.

Heat.—When urine contains albumen, and possesses its usual acid reaction, it begins to get turbid when heated to 140° F., and on the temperature being raised to boiling the albumen coagulates in flaky masses, which become more compact the longer the heat is applied. If the urine contain a large quantity of albumen it will coagulate at a somewhat lower temperature than a feebly albuminous urine, and if only a trace be present, no turbidity will take place until the urine begins to boil. This turbidity persists after the addition of an acid. When the urine is cloudy from the precipitation of amorphous urates (a certain indication of acid reaction), heat *alone* is a complete test for albumen; it is moreover the usual test. The best way of proceeding to test for albumen by heat is to fill a test-tube to the depth of about an inch with the suspected urine and to apply the flame of a spirit-lamp to the upper portion of fluid. If the urine be clear, the lower portions preserve their original transparency, while the upper portions (if albumen be present) become turbid; if the urine be cloudy from urates three distinct zones become visible when albumen is present: the upper one is turbid from the coagulated albumen; the middle is clear from the dissolution of the urates, which disappear at a lower temperature than is necessary to coagulate albumen; and the lowest portion, being unaffected by the heat, remains cloudy and unchanged. There are two points which it is necessary to remember when heat alone is employed as a test for albumen. The first is that when the urine is alkaline, albumen is not coagulated by heat; so that the acidity must be restored before the application of heat; this may be readily effected by the addition of a few drops of acetic acid. The second point is that a neutral or alkaline urine becomes turbid on heating from the precipitation of earthy phosphates; but this turbidity may be readily distinguished from that due to coagulated albumen, as the phosphates immediately disappear on the addition of a drop of any acid.

Nitric Acid.—This is the most delicate test for detecting minute quantities of albumen. The best way of using it is as follows: Fill a test-tube with the urine to the depth of about an inch, then, inclining the tube, pour in very slowly strong nitric acid in such a manner that it may trickle along the sides of the tube to the bottom, forming a stratum about a quarter of an inch deep below the urine. If it is added in this manner, there is scarcely any commingling of the two fluids. If the urine be albuminous, three layers will be ob-

[1] L'Union Méd. 1857, No. 155.

[2] Archiv des Vereins für wiss. Heilk. Bd. i.

served in the test-tube: at the bottom there is the colorless nitric acid; immediately above, a zone of opalescence from the coagulated albumen; and the unaltered urine above this. When only a trace of albumen is present the opalescent zone is not visible for several minutes. If the acid is not added in the manner just described, the *nitric acid test* is liable to two fallacies: for if the urine be feebly acidulated by the addition of only a drop or two of nitric acid, coagulation of the albumen is thereby prevented; while, on the other hand, if a large quantity of acid, say an equal volume, be suddenly added to the urine and mixed with it, no turbidity takes place, although the urine be highly albuminous. The reaction of the urine does not interfere with this method, but it is important to remember that in concentrated urines, and especially in febrile urines, the addition of the acid is liable to precipitate the amorphous urates, thus producing a turbidity which might be mistaken for albumen. To discriminate between these conditions, it is necessary to observe the level at which the cloudiness begins, and the direction in which it extends. Thus the turbidity due to coagulated albumen begins immediately above the stratum of acid and extends upwards; while that due to urates appears first at or near the surface of the urine, and spreads downwards. The application of heat also serves to distinguish the two reactions; for the urates are speedily dissolved when heat is applied, while the turbidity due to albumen remains unaffected by heat.

The slight opalescence which is commonly present in the urine of persons taking copaiba and cubebs is sometimes, but not always, increased by nitric acid in the cold; but the odor of these drugs is readily detected, while the application of heat diminishes the opalescence and prevents any turbidity with nitric acid. Nitric acid in the cold causes in urines rich in urea a slow precipitation of crystals of nitrate urea, which, however, is so unlike coagulated albumen that it can scarcely be mistaken for it.

The following practical directions may then be followed in proceeding to test for albumen: when the urine is cloudy from urates, use heat alone; when the urine is clear, or in any case if it be alkaline, add nitric acid in the way just described; if no turbid zone appear above the layer of acid, the urine may be certainly pronounced free from albumen; if, on the other hand, a turbid zone is produced, which is not dissipated on the application of heat, albumen is certainly present.

A number of other substances possess the property of coagulating albumen, among which may be enumerated alcohol, bichloride of mercury, sulphate of copper, alum, ferrocyanide of potassium, and creasote; but they are unsuitable for detecting albumen in the urine, because they precipitate at the same time some of the natural constituents of the urine.

The *quantitative* estimation of albumen in urine is a matter of considerable practical importance, and various plans of obtaining this object have been devised.

For precise determinations the plan usually followed is to bring a measured quantity of urine to a slightly acid condition; boil; throw on a weighed filter; wash; dry at 212°; and weigh. This proceeding demands a good deal of time. The filtering is sometimes impossible; and the results obtained are only moderately accurate with every care.

For a rough and ready, but useful, method, there is none superior to boiling the urine in a test-tube, and then adding a drop or two of acetic acid. The albumen coagulates in flakes, and presently sinks to the bottom, forming a layer of various thickness. The proportion of albumen is judged of by the depth of this layer as compared to the height of the column of urine in the tube. This proportion may be expressed in numbers, as $\frac{1}{2}$, $\frac{1}{4}$, $\frac{1}{12}$ and so forth. If the quantity of albumen be too small to form a layer of appreciable depth, the proportion is expressed more loosely, as a "cloudiness" or an "opalescence." The varying density of albuminous urines, and the varying size of the flakes into which albumen coagulates, affect the rapidity and completeness of the subsidence, and therefore the depth of the coagulated layer, so that only approximate results can be expected from this method.

Becquerel ingeniously turned to account the property of albumen to deviate the plane of polarization to the left, and constructed an instrument on a similar plan to the optical saccharimeter, by which the deviation could be measured and the percentage of albumen calculated therefrom. It would appear, however, that this instrument, on Becquerel's own showing, is only capable of very limited clinical application. When the quantity of albumen is considerable it gives very exact indications; but the deviation is too slight for exact estimation in moderately and feebly albuminous urines; it is therefore useless for the bulk of albuminous urines.[1]

Boedecker has recently proposed a volumetrical method, founded on the property of ferrocyanide of potassium to form an insoluble compound of fixed composition with albumen. Vogel states that he has found this method inaccurate.[2]

[1] See a clinical lecture by Becquerel, Clinique Européenne, 1859.

[2] Boedecker's method is described in Henle and Pfeufer's Zeitsch. 1859, p. 321.

New Process.—Dilution Method.—The writer has recently proposed a mode of estimating albumen in urine, which he thinks will prove very useful in clinical work.[1] The principle of the method is easily understood.

When an albuminous urine is progressively diluted with water, and tested from time to time with nitric acid, the opacity induced by the test becomes gradually fainter and fainter, until at length it ceases to be visible. This point is reached when the urine contains less than about 0·0014 per cent. of albumen. The more albumen the urine contains, the more dilution, of course, it will require to reach the vanishing point of the reaction; and if we could fix this point with accuracy we should have a simple method of estimating albumen in urine. The urine could be diluted until it ceased to react with nitric acid, and the amount of dilution required to reach this point would furnish a measure of the proportion of albumen.

But it is not possible to fix this point with accuracy. The opacity produced by the acid fades away so gradually with increasing additions of water, that it is impracticable to decide within many degrees the point at which the reaction ceases to be appreciable. And not only so, but the development of the reaction becomes more and more retarded as the dilution proceeds, until at length it only becomes visible after the lapse of several minutes.

To overcome this difficulty it was found necessary to fix on some arbitrary point or line which would serve as a practicable zero to the scale. After many trials it was found most convenient to draw the line at a reaction coming into sight midway between half and three-quarters of a minute after the contact of the acid—that is, to dilute the urine until it gives no reaction for thirty seconds after the addition of the acid, but shows a distinct opalescence at the forty-fifth second. The exact point to be aimed at is a reaction coming doubtfully into view between the thirty-fifth and fortieth second, and appearing, still very dim, but unmistakable, at the forty-fifth second. It was found possible, after a little practice, to strike this point with sufficient exactness to serve as a practical zero to the scale.

Each dilution with an equal volume is counted as one degree on the scale, and these degrees may be conveniently termed "degrees of albumen." Thus a urine requiring dilution with forty times its bulk of water to reach the zero-reaction may be described as possessing forty degrees of albumen—a urine requiring three hundred similar dilutions as possessing three hundred degrees of albumen, and so forth.

The difficulty of the method is to hit correctly the zero-reaction. When this point is approached, a little more or a little less dilution makes but a slight difference in the time at which the reaction appears. In order, therefore, to obtain exact results, it is necessary to conduct the testing with rigid uniformity. The test-tube employed should have an interior diameter of $\frac{6}{10}$ of an inch (15 millimetres); the acid must be added in the right way, and at the right moment. The operation, too, should be performed by daylight, or, if by gaslight, an addition of about five per cent. must be made to the results. The proceeding adopted is as follows: The urine is first tested in the usual way with nitric acid, so as to get a rough idea of the quantity of albumen contained in it, and of the degree of dilution likely to be required to reach the zero. The watch is placed on the table before the operator. A fluid drachm of the urine is then measured off and introduced into a graduated pint measure, and water is added up to a few or many ounces, according to the degree of dilution likely to be required to approach the zero-reaction. The test-tube is then filled to the depth of about an inch with the diluted urine, and held widely inclined from the perpendicular. The eye is now directed to the watch, and the acid is added in such a manner that it runs along the lower side of the tube to the bottom and forms a distinct layer, about a quarter of an inch deep, below the diluted urine. The acid must be added exactly on one of the quarter-minute strokes. This is the most critical step in the proceeding, and it should be performed in the following manner: A pointed glass tube or pipette is dipped to the depth of a couple of inches into the acid and covered with the forefinger. The pipette, thus guarded, is then passed into the test-tube to within half an inch of the level of the diluted urine, and at the right moment the finger is removed and the charge of acid delivered. As soon as the acid is added the test-tube is held up to the light against some dark background (such as a black sleeve, a book bound in black cloth, or a dark corner of the room), and as soon as the faintest opalescence is perceived above the level of the acid, the time of its appearing is noted. If this appear at or before thirty seconds after the contact of the acid, more water is added, and the testing repeated as before. Thus, by successive additions of water and repeated testings, a close approximation to the zero-reaction is obtained. A fresh dilution is then prepared, and

[1] For a fuller account of this method the reader is referred to a paper by the author, read before the Medico-Chirurgical Society, Feb. 22, 1876.

guided by the previous trials, two or three testings with different dilutions are generally sufficient to indicate with exactness the dilution which produces an opalescence between the thirty-fifth and forty-fifth second after the addition of the acid.

If too much water is added in the first instance, the reaction does not appear until after the forty-fifth second. In this case the operation must be re-commenced with less water, and proceeded with as in the first case.

When the zero-reaction is determined, the degree of dilution required to produce it is noted, and expressed in multiples of the unit-volume of the urine employed. Thus, if a fluid drachm was the unit-volume of urine employed, and the zero-reaction was obtained when dilution was carried up to fifteen ounces (120 drachms), the urine is recorded as having 120 degrees of albumen.

If the urine is feebly albuminous—indicating less than 20 degrees of albumen—the fluid ounce should be substituted for the fluid drachm as the unit volume. On the other hand, if the urine indicate more than 160 degrees of albumen, the unit-volume should be half a drachm—or, still better, the urine should be previously diluted with water in the proportion of 1 in 2 or 1 in 4, and the result afterwards multiplied by 2 or 4 as the case may be.

The actual value in weight of albumen of each degree on the dilution scale was found, by careful comparative experiments with the weighing method, to correspond to 0·0034 per cent., or 0·0148 grain per fluid ounce of the British Pharmacopœia. These data supply an easy means of calculating the quantity of albumen per ounce, and also the daily loss of albumen. Suppose that 40 ounces of urine were voided in twenty-four hours, and that a sample of this urine showed 150 degrees of albumen by the dilution method, then—

$$0{\cdot}0148 \times 150 = 2{\cdot}22 \text{ and } 2{\cdot}22 \times 40 = 88{\cdot}8.$$

The urine contained 2·22 grains of albumen per ounce, and the daily loss was 88·8 grains.

The time required for the estimation of albumen in urine by this method is from ten to twenty minutes.

Modified Albumen in Urine (Paralbumen).—Dr. Bence Jones has described a modification of albumen found by him in the urine of a patient suffering from mollities ossium. He regarded this substance as the hydrated deutoxide of albumen. The urine in which it was found was slightly acid, and of sp. gr. 1034·2; another specimen had a sp. gr. of 1039·6; it did not give a precipitate with nitric acid alone, nor by boiling, nor by adding nitric acid to the boiling urine. If however the urine was boiled and then allowed to cool, a precipitate was formed, which was immediately redissolved by heat.

The same substance has been found in the buffy coat of the blood in inflammation, and it is also met with in the albuminous fluid of pus.

Dr. Moore has published a case[1] in which albumen assumed a distinctly caseous modification in the urine for a short period. The urine when first examined contained albumen in its usual state; but that voided the following day coagulated with acetic acid, and formed repeated pellicles when evaporated. Seven days afterwards the urine contained no casein. In a case observed by Dr. Leared,[2] a modification of albumen, different from either of the above, was encountered. The urine became turbid with nitric acid, and again became clear when sufficiently heated. It behaved in the same way when heated with hydrochloric and phosphoric acids.

Clinical Significance of Albumen in the Urine.—In discussing this point it is necessary to exclude all those cases in which albumen is merely incidental to the presence of some other fluid in the urine, such as blood, pus, or, more rarely, semen. The excessive use of a too exclusively albuminous dietary, such as eggs, has been shown by Barreswil, Brown-Séquard, and others, to cause the urine to become slightly albuminous. Claude Bernard found that irritation of the renal nerves and of a certain spot in the floor of the fourth ventricle, higher up than the diabetic puncture, caused albumen to appear in the urine of animals. The same result followed the injection of the albumen of eggs, and even of a large quantity of pure water into the veins (Magendie). Any interference with the renal circulation produces albuminuria, as will be shown in the section devoted to Congestion of the Kidneys. Vogel found that inhalation of arseniuretted hydrogen and carbonic acid caused the urine to be abundantly albuminous. The notion that mercurial salivation produced albuminuria was long ago shown to be erroneous by Rayer; and his observations have been since confirmed by those of Dr. Francis, who examined the urine of fifteen salivated persons without finding a trace of albumen.[3] Slight and temporary albuminuria seems to occur in very exceptional cases apart from dietetic errors, from very slight disorders, as in the case of Beneke previously referred to. Similar observations have been made by Clemens, Rayer, and Solon. With these unimport-

[1] Med. Times and Gaz. 1866, ii. 525.

[2] Ibid. 1871, ii.

[3] "Diseases of the Kidneys," by G. O. Rees. Lond. 1850, p. 28.

ant exceptions, albuminuria must always be looked upon as a grave symptom of disease; and when its presence is established, it becomes of the utmost importance to the practitioner to know its true significance.

The pathological states in which albumen appears occasionally or constantly in the urine may be grouped under the following heads:—

1. Acute and chronic Bright's disease of the kidneys.
2. Pregnancy and the puerperal state.
3. Febrile and inflammatory diseases.
4. Impediments to the circulation of the blood.
5. A hydræmic and dissolved state of the blood and atony of the tissues; also hæmatinuria.
6. Saturnine intoxication.

In the *first group* albuminuria is always, and in the *second* frequently, dependent upon structural changes in the kidneys, and the reader is referred to the article on Bright's disease for the consideration of these heads in detail.

The *third group* comprises zymotic diseases such as scarlet fever, measles, smallpox, typhoid fever, cholera, yellow fever, ague, diphtheria, &c.; and inflammatory diseases such as pneumonia, peritonitis, traumatic fever, articular rheumatism, &c. In all such complaints a trace of albumen is occasionally found in the urine; it usually amounts to no more than a trace, and disappears on defervescence; sometimes the quantity is large in pneumonia.

In zymotic diseases there is a twofold pathological condition, viz. pyrexia and the operation of a specific poison; and albumen may appear in the urine either incidentally to the febrile state, when it is comparatively unimportant, or as an indication of serious structural changes in the kidneys, constituting a grave sequela of the disease. As intercurrent febrile attacks are common in the course of most chronic complaints, temporary albuminuria has been observed in very many different diseases — especially in chronic tuberculosis, cancer, caries, and necrosis; under such circumstances the albuminuria must be carefully discriminated from that produced by coexisting genuine Bright's disease.

The *fourth group* includes impediments to the circulation of blood from emphysema, heart disease, abdominal tumors, cirrhosis, &c., and will be discussed in the article on Congestion of the Kidney.

In the *fifth group*, albumen appears in the urine unconnected with organic changes in the kidney. It occurs in purpura, scurvy, pyæmia, hospital gangrene; it is also associated with the escape of the coloring matter of the blood and often with jaundice. (*See* Hæmatinuria.)

In the *sixth group*, albuminuria is due to saturnine intoxication. Albumen had long since been occasionally found in the urine of persons suffering from lead-poisoning, but it had been looked upon as a mere coincidence, until Ollivier[1] by experiment and clinical observation demonstrated their connection as cause and effect. Thus he found that the urine of dogs, rabbits, and guinea-pigs poisoned with repeated doses of carbonate of lead became albuminous, and that their kidneys showed signs of incipient organic disease. He also collected fifteen cases of albuminuria in persons poisoned with lead, seven of whom had temporary albuminuria; in three, the albuminuria persisted during the continuance of the plumbism; and in four, genuine Bright's disease had been produced. He also examined the urine of 37 persons with various manifestations of lead-poisoning in l'Hôpital de la Charité: of these, nine had albuminous urine. He found that both the urine and the kidneys in these cases contained traces of lead; and he inferred that the presence of lead in the kidneys induced an organic lesion of these organs, and that the albuminuria was the consequence of that lesion. These observations have been confirmed by Lanceraux[2] and Danjoy.[3]

When albumen is ascertained to be present in the urine, the important question to determine is, whether or not it indicates the existence of organic disease of the kidneys; and this can only be decided after a careful consideration of the three following points, namely:—

1. The temporary or persistent duration of the albuminuria.
2. The quantity of the albumen; and the occurrence and character of a deposit of renal derivatives.
3. The presence or absence of any disease outside the kidneys which will account for the albuminuria.

1. With the view of drawing a stronger line of demarcation between temporary and permanent albuminuria, Dr. Parkes[4] analyzed the adult cases treated by him in University College Hospital, in which the urine was examined carefully and daily for a sufficient length of time to enable it to be said with perfect certainty that albumen was or was not present during the whole course of the disease, or during any part of it. Cases of cystitis and vaginitis were not included: the

[1] Archives générales, 1863, ii. pp. 530 and 709.

[2] Union Médicale, 1863, and Bulletins de la Société Médicale d'Emulation, Nouv. Sér. t. i. 1864, i. p. 182.

[3] Archives générales, 1864, i. p. 402.

[4] "On the Composition of the Urine," Lond. 1860, p. 186.

cases were of the miscellaneous character usually admitted into a London general hospital. All cases of cholera and of pregnancy were excluded from consideration. Under the heading "Temporary Albuminuria," Dr. Parkes included cases in which albuminuria, after lasting some days, or even weeks, disappeared entirely for some time before the patient left the hospital; and under "Permanent Albuminuria," cases in which the albumen did not disappear during the time the patient was under observation—this time being generally very long, and always many days. The total number of cases tabulated was 303—170 men and 133 women. He found the proportion of cases of temporary albuminuria almost the same in the two sexes, viz. rather over 12 per cent.; while the proportion of cases of permanent albuminuria in males was 14·7 per cent. as against 10·5 in females: this difference is attributed to the greater prevalence of organic kidney disease in male hospital patients in London. The entire percentage of albuminous cases, both temporary and permanent, was in men a fraction over 27 per cent., and in women 22½ per cent. This percentage is considerably greater than that given by Dr. Barlow, who found that only 9 per cent. out of 300 cases investigated by him, had albuminuria. Of the 37 "temporary" cases, the largest number occurred in acute Bright's disease, pneumonia (acute, lobar), acute rheumatism, and typhoid fever. The quantity of albumen was "large" in the cases of pneumonia and acute Bright's disease; was in "some quantity" in the cases of typhoid, variola, and scarlatina, and "very small" in most of the remainder. Of the 39 cases of "permanent" albuminuria, disease of the kidney was either proved to exist, or rendered highly probable by other symptoms in 32; and as 3 other cases are excluded because nothing was decidedly known as to the state of the kidneys, permanent albuminuria indicated renal disease in 32 cases out of 36; and if the cases of heart-disease were eliminated, it indicated renal disease invariably.

2. *The greater the quantity of albumen the greater the probability of renal disease:* a large quantity is rarely found except in undoubted acute or chronic Bright's disease. In considering the amount of albumen discharged it is necessary to regard not only the proportion in the particular specimen under examination, but also the total quantity of albumen discharged in 24 hours. Thus a urine may be only slightly albuminous, but if the daily quantity amounts to four or five pints, the total loss of albumen will be very considerable, and the existence of renal disease strongly indicated. There is, indeed, no urine which more surely indicates the existence of Bright's disease than a pale, dilute, abundant urine, containing more or less albumen; on the other hand, it may be looked upon as a rule with very few exceptions that a slightly albuminous urine which is at the same time dense and high-colored does not indicate the presence of Bright's disease, and that the albumen in such cases is due either to a pyrexial state, or to some impediment to the circulation of the blood.

The microscopic examination of the deposit in the urine (if there be any) also furnishes important information. The deposits which indicate most strongly the existence of organic renal disease are those containing large numbers of tube-casts and renal epithelia—especially if these objects are dotted with oily globules. The deposits which are least indicative of primary renal disease of serious import are those which contain only blood-casts, or a very few small transparent casts.

3. When the urine is found permanently albuminous, and there is no pyrexia, or any other recognizable condition present which can account for the presence of the albumen, the inference is almost irresistible that primary organic disease of the kidneys exists.

It has been stated that it is possible to distinguish between incidental (nervous or idiopathic) albuminuria and albuminuria due to renal disease, by the fact that when certain odorous and pigmentary substances are taken internally they make their appearance in the urine as in health if the albuminuria be of the incidental variety, but not if it be due to disease of the kidneys. Dr. Dyce Duckworth's[1] observations do not support this conclusion. He found that (with some exceptions) iodine, santonine, turpentine, and oil of juniper passed through the kidneys, and appeared in the urine of persons affected with undoubted disease of the kidneys.

[1] St. Barth. Hosp. Reps. iii. 215.

CONGESTION OF THE KIDNEYS.

By William Roberts, M.D., F.R.C.P.

Definition. — An increase in the amount of blood in the vessels of the kidneys giving rise, if sufficiently intense, to the passage of albumen, blood, and even fibrinous casts of the uriniferous tubules with the urine; it may be altogether independent of any existing inflammatory action in the kidneys. Renal congestion is produced either by an undue supply of blood to the kidneys, or by some mechanical obstruction, impeding the return of blood from these organs. If long continued, structural changes are induced in the kidneys, which bear considerable resemblance to certain forms of Bright's disease. Dropsy is not a necessary concomitant of renal congestion; if it exists, it is most probably due to cardiac or pulmonary disease.

General Pathology. — When congestion of the kidneys is produced by undue determination of blood to those organs, it is termed *active;* and when due to impeded circulation, it is known as *passive* congestion. These forms of renal derangement comprise several conditions which have been grouped by Johnson, Frerichs, Griesinger, and other writers among the varieties of Bright's disease; but although these two classes of cases may be anatomically allied to each other, clinically and practically they are widely different; and it would obviously tend to mislead, if we unite under the heading of "Bright's disease" cases which, as we shall see, present such important differences in their symptoms and general clinical history.

To show that simple hyperæmia of the kidneys, without inflammation, will determine the appearance in the urine of albumen and blood, and even of fibrinous casts, we may briefly review the experiments which have been directed to this point, the first of which were performed by Dr. George Robinson on rabbits. He found that by tightly ligaturing the renal vein, or by making the obstruction incomplete, so that a certain amount of blood was still allowed to circulate through the kidneys, the urine invariably became more or less albuminous, and in most cases bloody. It was found, moreover, that the kidney whose vein was obstructed in this manner was heavier than its uninjured fellow in a proportion varying from $1\frac{1}{3}$: 1 to 3 : 1.[1] These experiments were repeated by Frerichs with exactly similar results in dogs, rabbits, a cat, and a frog. He also detected casts of tubes in the urine in four out of ten experiments, and in one he observed the presence of renal epithelium.[2]

The rationale of these experiments is simple: the blood accumulating behind the obstruction causes increased lateral pressure upon the walls of the renal vein and its branches. This increased tension is transmitted backwards to the renal capillaries, which in turn become engorged, and their walls are thereby attenuated—a condition highly favorable to the transudation of the serous constituents of the blood through their coats. If the tension be carried to a still farther extent, actual rupture of the capillaries takes place, and blood corpuscles as well as albumen escape with the urine. The Malpighian tufts, from their anatomical arrangement, afford facilities for the ready passage of blood and serum into the urine, and it is thereby rendered probable that in them the transudation process begins, and goes on with increased activity.

Robinson found that increased *arterial* tension does not so readily determine the passage of albumen and blood into the urine; and his conclusions have been confirmed by Frerichs and Meyer. Endeavoring to test the effect of increased arterial pressure on the urine, Robinson removed one kidney, thinking that the physiological determination of blood to the other might be sufficient to produce albuminuria; but although the experiment was performed five times, in only one instance was the urine albuminous. He then tied the abdominal aorta below the origin of the renal arteries in two weak rabbits, but albumen only appeared in the urine of one.[3] He next removed (to quote his seventh experiment) the left kidney of a middle-sized rabbit; it weighed fifty-four grains. The aorta was then tied below the origin of the renal arteries, and the animal killed two hours afterwards; the

[1] Med.-Chir. Trans. 1843, p. 51.

[2] Die Bright'sche Nierenkrankheit, 1851.

[3] Frerichs states that he could only find traces of albumen in a few cases after such an operation. Meyer, however, saw abundant albuminuria follow this procedure.

right kidney weighed eighty-five grains, and contained six or seven ecchymoses of various extent. The bladder contained about a drachm of bloody and albuminous urine, and this was the invariable result of similar experiments.

Hermann[1] and Overbeck[2] induced artificial albuminuria by temporarily obstructing the circulation in various ways. Thus Hermann tied the renal arteries for a short time, and found that the urine secreted after the ligature was removed was invariably albuminous. Overbeck, in one set of experiments, inflated a bladder previously introduced flaccid into the heart, and allowed it to remain for about a minute; in a second set he produced asphyxia and consequent arrest of the blood-current by compressing the trachea for four minutes: in both series of experiments, the urine which first flowed after the re-establishment of the circulation was always albuminous and frequently bloody. The albuminuria generally persisted a few hours and then passed away. When shedding of the renal epithelium occurred, it always *followed* the appearance of the albumen, showing that this could not have produced the albuminuria. The probable explanation of these results is, that the Malpighian tufts became engorged in consequence of the temporary interruption of the blood-current, the re-establishment of which produced increased pressure in the renal capillaries, *i. e.*, it produced active congestion of sufficient intensity to cause albumen and blood to appear in the urine.

Results of Renal Congestion.—The inevitable result of persistent and long-continued impediment to the renal circulation is the induction of grave structural changes in the kidneys; the continuance of hyperæmia must of necessity modify the nutrition of the gland-elements, while the presence of blood corpuscles and fibrinous plugs in the delicate tubuli cannot fail to induce eventually more or less extensive destruction of those structures. It would also appear that an excessive production of adventitious connective tissue, leading ultimately to contraction and atrophy, is one of the most important results of long-continued congestion of the kidneys.

(A.)—Active Congestion.

Synonym.—Catarrhal Nephritis (Virchow, Rosenstein).

Etiology and Pathology.—The kidneys participate in the general hyperæmia of the internal organs which occurs in the course of eruptive and continued fevers, of croup, diphtheria, cholera, erysipelas, pyæmia, acute rheumatism, pneumonia, and other inflammatory diseases; they are not unfrequently however the seat of a disproportionate determination of blood, leading to the presence of albumen in the urine. As a rule, there is a mere trace of albumen found in these cases, which diminishes *pari passu* with defervescence, and in a few days totally disappears; but sometimes it is more abundant and accompanied with a few blood-corpuscles, transparent tube-casts, and scattered renal epithelium: tenderness in the loins is sometimes present.

This condition is distinguished from genuine Bright's disease, which may occur in connection with the same pyrexial maladies, by the absence of anasarca, by the undiminished urea-excretion, and by the period of its occurrence: thus albuminuria from congestion coincides with the height of the fever, and subsides therewith; genuine Bright's disease, on the contrary, occurs as a sequela, toward the close of the pyrexial stage or at the beginning of convalescence.

The pathological appearances when death has taken place from the primary fever during active renal congestion are the following: the organs are enlarged and engorged with blood and present minute ecchymotic patches throughout their substance; Virchow has pointed out the existence in these cases of a catarrhal condition of the canals of the pyramids characterized by the detachment and disintegration of the epithelium of the straight tubes: the epithelium sometimes undergoes fatty metamorphosis.

The frequency of this complication of zymotic diseases varies in different epidemics. During a severe typhus epidemic in 1857, Rosenstein found that most of the patients had transient albuminuria with tube-casts, unattended, however, with serious consequences: in the sporadic typhoid of Manchester, albuminuria is decidedly rare.

Another not very common, perhaps (as suggested by Rosenstein) because often-overlooked cause of active renal congestion, is simple exposure to cold, quite independently of any specific fever. If the urine does not happen to be examined, the case will probably be considered a simple febricula, the symptoms of the two affections being very similar.

Certain irritants act as special stimuli of the urinary organs, and excite hemorrhage from the kidneys and lower urinary passages. Among these may be enumerated cantharides, turpentine, cubebs, copaiba, nitrate of potash, and also, in very rare cases, quinine and arsenic. Bouillaud found that when large blisters were

[1] Sitzungsberichte der mathem. naturw. Classe der kais. Akad. Vienna, 1861, p. 26.

[2] Ueber den Eiweissharn, ibid. Feb. 1863.

applied to scarified portions of the skin, albumen almost invariably appeared in the urine, ceasing generally in two or three days: in a few cases it persisted for weeks. After death, the kidneys were found strongly congested and studded with minute ecchymoses, the mucous membrane of the pelvis and ureters, sometimes also of the bladder, injected, and covered here and there with false membranes.

Dr. Johnson records a case in which a few hours after the administration of half an ounce of turpentine the urine was bloody and contained "blood-casts," with a few small inflammatory cells, but no epithelium. On the sixteenth day, the urine was free from albumen and blood.

The writer has known one person in whom quinine invariably produced hæmaturia; two similar cases are cited in the *British Medical Journal*, vol. i. 1870, p. 11. This effect is probably due to idiosyncrasy.

Two cases of poisoning by sulphuric acid are related by Leyden and Munk, in which the urine contained albumen and tube-casts.[1]

Frerich includes irritants of this class among the exciting causes of genuine Bright's disease, and cites two cases by Reinhardt, in which the abuse of copaiba and cubebs was followed by renal degeneration, which proved fatal in one case; but, as Rosenstein points out, the kidneys were probably diseased prior to the administration of the irritants. There is no sufficient evidence to prove that genuine Bright's disease has really ever followed an overdose of any of these stimulants.

Albumen and even blood not unfrequently appear in the urine in the later stages of diabetes; the excessive action of the kidneys in this disease keeps up a constant congestion of these organs, and permanent structural changes ultimately take place—degeneration of the epithelium, development of cysts, and other morbid changes—which are classified with genuine Bright's disease.

In rare instances, active renal congestion causing albuminuria seems to be attributable to the compensatory hypertrophy of the left ventricle which follows aortic regurgitant disease. In this condition the propulsion of blood into the aorta when the orifice is patulous, takes place with very great force, and the arterial tension at the close of the ventricular systole rises constantly above the normal maximum, though it may be counterbalanced or even more than counterbalanced by undue diminution of tension during the ventricular diastole. In practice, this form of congestion seems to be rare, however; the writer has repeatedly examined the urine of persons with immense enlargement of the left heart, and in only three or four instances has he found albumen in the urine. In a case recorded by him,[1] in which there was enormous hypertrophy of the left ventricle, it was distinctly observed that the proportion of albumen oscillated with the activity of the heart; when the ventricle was in high action, the albumen increased, and when it became more quiescent under treatment the albumen almost disappeared.

[1] Archiv. i. Path. Anat. Bd. xxii. p. 237.

(B.)—Passive Congestion.

Etiology and Pathology. — That this form of renal derangement is produced by an impediment or obstruction to the return of blood from the kidneys is clearly shown by the results of the experiments of Robinson, Frerichs, and others already cited. Two degrees of this obstruction are encountered clinically; if sufficiently intense, albumen and blood appear in the urine, but if insignificant, the urine is not rendered albuminous but becomes scanty, high-colored, dense, and prone to deposit lithates copiously. These changes in the characters of the urine are not always proportionate to the amount of obstruction to the circulation; for cases are occasionally met with in which the urine contains not even a trace of albumen while the symptoms of intense venous congestion, dropsy, orthopnœa, and pulsating jugulars are present. In other cases, the urine may be albuminous and bloody, while the general symptoms of venous obstruction are by no means strongly marked.

The obstruction may be seated in the chest or in the abdomen; if in the chest, it may be due to valvular heart disease, to emphysema, or to pleuritic effusion: if in the abdomen, it may be produced by the pressure of a gravid uterus, a cirrhotic liver, or other tumor on the upper course of the inferior vena cava, or upon the emulgent veins.

Robinson in the course of his experiments found that vigorous animals exhibited the urine-changes after ligature of the renal veins in much greater intensity than weakly animals: this difference he attributed to the fact that in strong animals the powerful contractions of the ventricle served to maintain a greater counter-pressure on the arterial side of the renal circulation, and so intensified the intra-renal pressure or congestion. That this holds good clinically as well as experimentally is well illustrated by the case of a woman, aged forty-two, suffering from excessive and universal emphysema, observed by the writer. In this case, the albumen,

[1] Op. cit. p. 344.

which amounted to one-third when she first came under observation, gradually disappeared, although the intra-thoracic obstruction gradually increased, and eventually produced death by asphyxia. This was explained by the diminishing pressure in the arterial system from gradual failure of the heart's power, in consequence of the inability to take food, which diminished the mass of the blood, and the increasing blood-poisoning from defective aëration, which gradually depressed and ultimately destroyed the contractility of the ventricle.

The state of the kidneys in passive congestion varies with the duration of the obstruction. If recently established, the kidneys are found simply enlarged and engorged, as in the case of the rabbits whose renal veins were tied by Robinson. But when the obstruction has lasted for months or years, certain alterations in the renal structure take place. The following description of the kidneys in old-standing passive renal congestion is based on a comparison of several accurate examinations. The organs are uniformly reddened and are decidedly smaller and harder than natural; their surface is generally smooth, but sometimes granular, the proportion of cortical to pyramidal substance is not much altered; in very chronic cases, the cortex may be somewhat atrophied. The epithelium of the convoluted tubes is irregular, sometimes fatty, and frequently contains pigment. The straight tubes are often dilated and varicose, being filled with granular, opaque epithelium. The basement membrane of the canals is thickened, and the venous radicles are greatly dilated. The Malpighian bodies are highly injected but otherwise natural, except in very protracted cases, when they become a little atrophied, and thickening of their capsules takes place. The inter-tubular connective tissue is increased in quantity, especially in the pyramidal portions.

However great may be the difficulty in separating these cases from chronic Bright's disease anatomically, the different course of passive renal congestion from that of Bright's disease of independent origin, and of Bright's disease coming on in the course of chronic bone-disease or phthisis, renders their clinical differentiation very simple. In passive congestion, the renal derangement oscillates *pari passu* with the rising and falling intensity of the venous obstruction, making no independent progress, but remaining throughout a subsidiary complication of the primary affection, and developing none of the special characteristics of Bright's disease, as uræmia and the like. When renal disease declares itself in the course of chronic phthisis, its course forms a complete contrast to that of congestion. It at once assumes a formidable position, changing the entire clinical aspect of the case; the pulmonary affection sometimes even undergoes a retrograde process, and is as it were supplanted by the more rapidly fatal renal disorder.

Treatment of Active and Passive Renal Congestion.

Congestion of the kidneys, whether active or passive, does not often call for separate treatment, as its course and intensity are usually contingent on the progress of the primary disorder of which it is a secondary phenomenon. Sometimes, however, active congestion is of independent origin, or, although secondary, it may be sufficiently threatening to demand special attention. The most efficacious agents in the treatment of active renal congestion are perfect rest of the body, cupping the loins, brisk purgatives, the warm bath, and other diaphoretics.

Passive congestion from cardiac and pulmonary obstructions can be most efficiently relieved by the use of appropriate remedies for the primary ailments; but when it is due to the pressure of a pregnant uterus, it not unfrequently claims energetic treatment on its own account. Cupping can only be of service when the congestion is due to a temporary cause, such as pregnancy, and here it is sometimes of signal benefit. In the more ordinary forms, the application of gentle counter-irritants will be found more serviceable; at the same time, derivation by the bowels and skin will materially aid in relieving the over-loaded organs.

BRIGHT'S DISEASE.

By William Roberts, M.D., F.R.S., F.R.C.P.

Definition.—A generic term embracing certain types of acute and chronic renal disease, characterized by albuminuria and dropsy, and frequently also by the supervention of various secondary conditions, due to a deteriorated condition of the blood.

Synonyms. — Albuminuria; Morbus Brightii (Lat.); Maladie de Bright (Fr.); Die Bright'sche Nierenkrankheit (Germ.); Malattia di Bright (Ital.).

History, Classification.—Although a connection had been previously shown by Dr. Blackall to exist between dropsy and albuminuria, Dr. Bright was the first to establish the coexistence of these symptoms with certain morbid conditions of the kidney by the publication of his "Report of Medical Cases" in 1827. His researches on this subject were followed up by those of other observers, notably by those of Sir Robert Christison; and about this time considerable impetus was given to the study of renal diseases by the researches of Mr. Bowman on the minute anatomy of the kidney. It would obviously lead us too far to give an account of all the work subsequently done in this field; suffice it to say that the histological researches of Busk, Toynbee, and Simon in this country, and of Henle, Rokitansky, and Virchow in Germany—and the clinical observations of Johnson, Frerichs, Basham, Dickinson, Grainger Stewart, and many others, have combined to elucidate the subject by throwing much light on its pathology, and by furnishing us with important data for prognosis and treatment. The labors of Dr. George Johnson, more especially in the microscopic examination of the organic admixtures of the urine—renal epithelium and casts of the uriniferous tubes—have yielded results of the highest clinical value, and entitle him to a pre-eminent notice in this field of pathology.

The varieties of Bright's disease, while presenting considerable diversity not only in the acuteness of their course, but also in their modes of origin and in their symptoms, yet have points of resemblance so strong and so numerous, that they form an easily recognized clinical group. This resemblance is due in great measure to the circumstance that the structural changes in the kidneys, however varied, produce the same ultimate results, namely, impoverishment of the blood from loss of albumen, with blood-poisoning from retention within the body of the excrementitious matters of the urine; and the more prominent symptoms in Bright's disease arise from this changed composition of the blood, rather than from the *direct* effect of the organic changes in the kidneys.

Numerous attempts have been made to classify the varied conditions of the kidney found after death from Bright's disease and to associate each with its appropriate clinical history; hitherto, however, no classification has received general assent, and it is to be regretted that the result of these attempts has chiefly been to add a confusing nomenclature to the inherent difficulties of the subject. Opinions are divided, in the first place, as to whether a fundamental unity underlies the apparent diversity, *i. e.*, whether the "large, smooth, white kidney," the "small smooth kidney," the "granular uncontracted kidney," and the "granular contracted kidney," are successive stages of one and the same pathological process, or represent essentially different diseases. The distinguished physician of Guy's Hospital, whose name has been given to this group of diseased conditions, was by no means certain that his conjecture that there were three different forms of disease was a correct one; "on the contrary," he remarks, "it may be that the first form of degeneracy to which I refer never goes much beyond the first stage; and that all the other cases, together with the second series and the third, are to be considered only as modifications, and more or less advanced states of one and the same disease."[1] Notwithstanding all the work which has been done in the field opened up by Bright, the doubts expressed by him are not yet wholly cleared up.

Frerichs considers that Bright's disease is essentially *one*, and that it is of an inflammatory nature. He recognizes three forms of anatomical change in the kidney, which he regards as progressive stages of the same pathological process, namely:—

[1] Report of Medical Cases, by Richard Bright. Lond. 1827, p. 69.

1. The stage of hyperæmia and commencing exudation.
2. The stage of exudation and commencing change of exudation.
3. The stage of degeneration and atrophy.[1]

Dr. Johnson, on the other hand, recognizes several distinct processes under the generic heading of Bright's disease. There are two principal varieties according to him, both of which are of an inflammatory nature: the one is characterized by shedding and more or less complete disintegration of the epithelial lining of the uriniferous tubes, and was named by him *desquamative nephritis;* in the other, no such desquamation takes place, but the intertubular structures are the portions of the organ affected, constituting his *non-desquamative nephritis.* Besides these, he assigns a separate place to "fatty degeneration" and to "waxy degeneration" of the kidney.[2]

Dr. Dickinson, in his treatise,[3] divides Bright's disease into three main groups:—

1. Tubal nephritis—in which the uriniferous tubes are the seat of inflammatory action.
2. Granular degeneration—in which there is increase and subsequent contraction of the intertubular matrix of the kidney.
3. Depurative disease—synonymous with what is known as amyloid, waxy, or lardaceous infiltration of the kidneys.[4]

Dr. Grainger Stewart, in his work on "Bright's Diseases,"[5] a term which he regards as more truly descriptive than "Bright's disease," adopts the nosological arrangement of Virchow with certain modifications. He classifies the cases in the following manner:—

1. The inflammatory form—of which there are three stages:—
   (*a*) That of inflammation.
   (*b*) That of fatty transformation.
   (*c*) That of atrophy.
2. The waxy or amyloid form—of which also there are three stages:—
   (*a*) That of degeneration of the vessels.
   (*b*) That of secondary changes in the tubes.
   (*c*) That of atrophy.
3. The cirrhotic, contracting, or gouty form.

In addition to these, he describes two mixed types, in which the waxy and cirrhotic forms are respectively combined with the inflammatory form.

Without entering into a discussion of the merits of these and of many other classifications which have been propounded, the writer would merely indicate that in the following pages the classification adopted is based on clinical, in preference to anatomical, characteristics. Two main divisions are therefore made—Acute and Chronic Bright's disease. The former embraces a compact and universally recognized group formerly known as "inflammatory dropsy;" it corresponds to the first stage of Frerichs, to the acute desquamative nephritis of Johnson, and to the acute tubal nephritis of Dickinson. The latter division includes the protracted cases, which have either passed from the acute form into a chronic state, or, which is far more frequent, have been chronic from the first. Three types of chronic Bright's disease are recognized:—

1. Cases which have lapsed from the acute state (kidney smooth, white, generally large, exceptionally dwindled).
2. Cases which have been chronic from the beginning (kidney granular, red, contracting).
3. Cases associated with waxy, lardaceous, or so-called amyloid degeneration of the kidneys.

The presence of fat in the renal substance and in the epithelium of the tubes not being limited to any special type of renal degeneration has no claim to a separate consideration.

General Etiology of Bright's Disease.

It will be convenient to consider some points bearing on the etiology of Bright's disease as a whole, leaving the special etiology of each type to be considered separately under its own heading. To obtain an idea of the *prevalence* of Bright's disease, some inferences may be deduced from the returns of the Registrar-General, the value of which is, however, greatly diminished by the want of uniformity in nomenclature. Cases registered as deaths from Bright's disease are entered in these returns as "nephria," but it is evident

[1] Die Bright'sche Nierenkrankheit. Braunschw. 1851.

[2] On Diseases of the Kidneys. Lond. 1852; and Med.-Chir. Trans. vol. xlii.

[3] On the Pathology and Diseases of the Kidney, Part II. Lond. 1877.

[4] In his recently issued second edition, Dr. Dickinson gives up the term "depurative," and adopts the old term "lardaceous."

[5] A Practical Treatise on Bright's Diseases of the Kidneys. 2d edit. Lond. 1871.

that the larger number even of the cases of Bright's disease recognized as such during life, are not so registered, but are classified under "nephritis" and "kidney disease." During 1874, 3342 deaths were registered in England from "nephria," 864 from "nephritis," and 2999 from "kidney disease," making a total of 7205. This yields a proportion of only 1·4 per cent. of the total deaths from all causes—a number probably considerably below the true proportionate mortality from Bright's disease; in all likelihood, however, a large number are overlooked in these returns and are to be found among the 4688 entered under "dropsy," or among those entered under "convulsions," "pneumonia," and other headings.

Age and Sex.—Bright's disease is nearly one-fourth more common in men than women, the proportion being 1936 males to 1406 females. This excess of deaths among males obtains at every age, but is not equal at the different periods of life, being most marked between forty-five and sixty-five. The mortality from Bright's disease shows a progressive increase from childhood up to about the age of fifty; during the next twenty years the mortality continues steady at a somewhat lower rate; but during the succeeding decade a decided diminution in the mortality from Bright's disease takes place, although at this epoch the general mortality is at its highest point. These facts are exhibited in the following table:—

Table showing the number of Deaths registered as "Nephria" (Bright's Disease) in England in 1874 at the different periods of life.

	Under 5 yrs.	5–15 yrs.	15–25 yrs.	25–35 yrs.	35–45 yrs.	45–55 yrs.	55–65 yrs.	65–75 yrs.	75 yrs & upw.	Total at all ages.
Males . . .	89	79	116	220	332	398	359	240	89	1936
Females. . .	54	72	107	216	239	229	234	193	60	1406
Both Sexes . .	143	151	223	436	571	627	593	433	149	3342

Cold.—The complex series of impressions comprised in the familiar phrase "taking cold," is a very common cause of Bright's disease in its acute form, while the more slow and continuous operation of cold is a fruitful source of chronic Bright's disease. Hence persons whose occupation exposes them to cold and damp, and the inclemency of weather—those who work in hot workshops, and are liable to sudden vicissitudes of temperature—the indigent classes living in damp cellars, ill-fed, and insufficiently clothed—all these are specially liable to become the victims of Bright's disease.

Various theories of the *modus operandi* of cold in inducing renal disease have been advanced. It has been supposed that the mere diversion of increased quantities of fluid as in checked cutaneous excretion is sufficient to inflame the kidneys; but it is beyond question that when much fluid is taken into the system the kidneys may be caused to excrete many times the natural amount of urine and no inflammation result. Dr. Johnson contends that the defective action of the skin causes certain deleterious matters to accumulate in the blood, and that the burden of their elimination is thrown upon the kidneys to their injury; but it must be remembered that suppressed cutaneous transpiration ushers in a multitude of inflammatory and febrile conditions without inducing renal disease: it is impossible to predicate—when a person has "taken cold"—what organ will be affected—whether the pleura, the lung-tissue, the bronchial tubes, or the kidneys, or some other organ or part of the body. No *special* relation between suppressed cutaneous secretion and the genesis of renal disease can therefore be said to exist.

Intemperance.—The abuse of spirituous liquors is a prominent determining cause of Bright's disease. Sir R. Christison estimates the proportion of cases due to this cause in Edinburgh as three-fourths or four-fifths of the total number. He observes that dram-drinkers who regularly take ardent spirits several times a day short of intoxication are liable to renal disease as well as habitual drunkards. Dr. Dickinson has devoted a chapter in his recent work[1] to the consideration of alcohol as a cause of renal disease. From pathological observations made on the bodies of persons who had died of delirium tremens, or from the abuse of spirituous drinks, and from a want of correspondence between the death-rate from Bright's disease as shown by the Reports of the Registrar-General and the degree of intemperance prevailing in different localities, he concludes that the use of alcoholic drinks is comparatively inoperative as causing diseases of the kidneys. The writer has elsewhere[2] examined these data, and has shown, he believes, conclusively that the arguments advanced by Dr. Dickinson are inadequate to disturb

[1] Op. cit. p. 600.

[2] Brit. Med. Journ. vol. ii. 1871, p. 521.

the old and almost universal opinion respecting the injurious influence of alcohol on the kidneys.

Malt liquors, though less pernicious than spirits, are also influential in the production of Bright's disease, if freely indulged in; and as intemperate habits frequently accompany personal uncleanliness and exposed occupations, laborers, cabmen, carters, hawkers, and persons under similar circumstances, form an undue proportion of the victims of Bright's disease.

Constitutional Vice.—Many of the chronic cases are associated with tuberculosis or struma and chronic plumbism; while gout and constitutional syphilis are by no means infrequent antecedents among the wealthier classes.

Ague.—The writer has not met with a case occurring sequential to ague. Becquerel and Frerichs also have never found evidence of kidney disease in dropsies following intermittent fevers. Rosenstein, however, found that 23 per cent. of the cases of Bright's disease in the Dantzic Hospital were referable to antecedent ague. The frequency of this complication is influenced by the character of the epidemic as shown by Heidenhain; he found that neither dropsy nor renal mischief occurred in the earlier epidemics observed by him in Marienwerder, but in the latest epidemic secondary renal disease followed in almost every case.

Pregnancy.—While women who are the subjects of Bright's disease may become pregnant, and pregnant women are liable, like other people, to contract Bright's disease from any of its ordinary causes, there is a third category in which pregnancy has really caused Bright's disease. The Registrar-General's reports furnish some valuable evidence on this point. In the five years between 1857 and 1861, 6220 deaths were registered from Bright's disease. Of these 3699 were males and 2521 females—the relative proportion of the sexes at all ages being sixty-eight females to every hundred males; but during the child-bearing period (from twenty to forty-five), the proportions were eighty women to every hundred men, while after the age of forty-five the proportionate mortality from Bright's disease fell to fifty-nine women for every hundred men. The only conclusion that can be drawn from these statistics seems to be that pregnancy is a fruitful cause of Bright's disease.

Chronic affections of the lower Urinary passages.—The foundations of renal disease are frequently laid by chronic cystitis, long-standing stricture of the urethra, and other local affections. The etiology of these cases is discussed in a separate article (Secondary Diseases of the Kidney).

A large number of cases of chronic Bright's disease occur in which no exciting cause can be detected; in some of these the renal disorder is only a part of some wide-spread cachexy, such as atheromatous or lardaceous degeneration.

Wells and Blackall believed that mercury was capable of producing albuminuria and renal mischief; but Rayer and Desir out of forty cases treated with mercury at the Hôpital des Vénériens only found a slight quantity of albumen in two, in both of which the existence of pus accounted for its presence. Rayer also states that for years he had used mercurial preparations therapeutically, and had also treated a large number of gilders with mercurial trembling, without having observed a single case of dropsy with coagulable urine.

(A.)—Acute Bright's Disease.

Synonyms. — Inflammatory Dropsy; Acute Diffuse Nephritis; Acute Desquamative Nephritis (Johnson); Acute Tubal Nephritis (Dickinson).

Morbid Anatomy.—The kidneys are always enlarged, sometimes to twice their normal sizes; their surface is smooth and generally of a deep, dusky-red color, but sometimes a pale fawn, or it may be mottled red and white. The capsule is thin, transparent, and easily stripped off; the superficial veins are larger and more distinct than natural. On section, the red congested kidney exudes abundantly a bloody sanies from the cut surface, which is of a dusky red hue, and studded with minute darker red points—the engorged Malpighian corpuscles; a number of hemorrhagic spots may usually be seen scattered through the cortex or beneath the capsules. The cortical substance is found relatively much increased. The pale and the mottled kidneys present a contrast of color between the cortex and the pyramids. The latter appear unnaturally red, and radiating lines of red spread, fanlike, from their bases into the cortical substance which is smooth, white or yellowish white, and spotted like ivory.

Under the microscope the chief and characteristic alteration is found to be an immense increase of the epithelium, mixed with more or less blood, choking up the lumen of the convoluted tubules, whose diameters, in extreme examples, are increased to twice or even thrice their normal size. The individual cells may be natural; more commonly they are granular, opaque, or disintegrated; they sometimes contain a few oily particles. The straight tubes afford evidence of the same process but in a less intense degree, for their larger bore and direct course favor the escape of the detached epithe-

lium, so that some of them are partially or wholly denuded. Fibrinous exudation is found in the tubes of the cortical and pyramidal portions in the form of transparent cylinders of various size, according as the tubes have preserved or have shed their proper epithelial lining. The intertubular matrix is unaffected, and the renal capillaries and Malpighian tufts are either natural or intensely injected.

Pathology.—The disorder is essentially a catarrh of the uriniferous tubes with enormously increased epithelial growth. The first step in the morbid process is an inflammatory congestion of the organs with rapid swelling, and more or less extensive rupture of the capillaries, especially those of the Malpighian tufts; then increased production of epithelial cells, packing up and distending the tubules, and thereby compressing and impeding the circulation through the renal capillaries. The depurating functions of the organs are thus necessarily impeded, and the blood is poisoned with excrementitious matter; the urine becomes scanty and deficient in its proper constituents, and as it percolates through the diseased ducts it detaches whole tracts of their epithelial lining or carries with it loose epithelium, blood, and fibrinous exudation, which forms the grumous sediment seen in the urine in these cases. The pale or mottled appearance of the kidneys sometimes observed is due to the extreme proliferation of the epithelium, which overpowers the natural red color, rather than to a positive deficiency of blood in the organs. The writer has seen this condition attain an extreme degree in six weeks: Dr. Dickinson states that it may occur within four days.

Course and Symptoms.—The disease is usually traceable to some definite exposure to cold or a fit of intemperance, or it occurs as a sequela of scarlet fever or (very rarely) of some other zymotic disease. It is generally ushered in abruptly with the usual symptoms of pyrexia—chilliness or rigors, soon followed by febrile reaction, headache, nausea, vomiting, dryness of skin, and dull pain and tenderness in the loins. Dropsy is an early symptom: the face first becomes pale and puffy, thus acquiring a heavy, stupid expression; this is followed by general anasarca, which is resistent on pressure, and pits very slightly, if at all, and by effusion into one or more of the serous cavities.

Urine.—There is a frequent desire to urinate, especially when the patient is recumbent. The quantity of urine in the earlier periods is greatly diminished, in extreme cases it may be reduced to four or six ounces in the twenty-four hours, or it may be even totally suppressed for two or three days. It is usually of a smoky or dusky hue—in some cases dark-brown like porter; its natural odor is replaced by a faint, unpleasant smell like that of "flesh-washings." It is commonly acid; rarely alkaline from fixed alkali. Its specific gravity ranges between 1,020 and 1,030; in one instance which occurred to me, it was 1,065. It is highly albuminous, sometimes becoming quite solid on boiling. On standing it deposits a copious, flocculent, chocolate-colored sediment which, on microscopic examination,

Fig. 88.

Transparent, granular, blood and epithelial casts from a case of acute Bright's disease; free renal epithelium; and blood disks.

is found to consist of blood-corpuscles, loose renal epithelium and free nuclei, tube-casts, shapeless masses of coagulated fibrine, and the broken debris of all these structures, besides epithelium from the renal pelvis and the bladder. (See Fig. 88.) The tube-casts are abundant and varied: the most common are of "medium" size, transparent, and studded with epithelium or blood-disks; along with these may be some "very large" and some "very small" hyaline casts, together with opaque granular casts. Rarely a few small specks of oil may be seen either on the casts or within the epithelia, in the early stages of the disease. The quantity of albumen in the urine varies from eighty to about 400 grains per day; the proportion per 1,000 parts during the height of the disease has been variously estimated by Frerichs as ranging between 8·2 and 24·8, by Christison as 27, and by Heller as 57. The natural solid constituents of the urine are diminished according to the obstruction in the

kidneys: the excretion of urea falls from 400 or 500 grains to 100 or 200 grains, and the inorganic salts are considerably reduced, while uric acid maintains about its usual quantity.

Blood.—Owing to the unnatural drain through the kidneys, the blood becomes poorer in albumen and more watery, while undue accumulation in it of urea, uric acid, and extractives takes place. As the disease advances, general anæmia is produced by the diminution of the blood-disks. Fibrine is usually in excess and the blood exhibits a buffy coat: fat and inorganic salts retain their normal ratio. Frerichs gives the three following analyses of the blood in the early period of acute Bright's disease:—

	I.	II.	III.
Specific Gravity	1025	1022	1019
1000 parts of serum contained:—			
Water	908·10	915·88	938·9
Solids	91·90	84·12	61·1
Albumen	81·40	72·00	51·7
Fat	1·42	1·53	9·4
Extractives and Salts	9·09	10·59	

TERMINATIONS.—After a period varying from a few days to some weeks, the disease proceeds to one of three terminations: it may end in recovery, in death, or by lapsing into the chronic state.

In the most favorable cases the urine first improves; its quantity increases to three or four pints daily; its density falls below the natural mean; the blood, tube-casts, and albumen gradually disappear from it, and *pari passu* with the changes in the urine, the skin becomes moist, and the serous effusions are re-absorbed. The rate of progress varies extremely: if the urine is perfectly free from albumen within six weeks or two months, recovery may be regarded as rapid. The shortest period that I have known to elapse between the earliest symptoms and the complete re-establishment of the normal state, was ten days.

But in other cases convalescence is protracted over eight, twelve, or eighteen months, during which, the urine continues abundant, of low density, and often of a pink color from slight admixture of blood; the anasarca may recur and disappear several times, accompanied with slight febrile exacerbations. In one such case observed by me the symptoms finally subsided in five months, the urine being perfectly free from albumen ten months later; and in a second case, the urine contained a slight admixture of blood for more than a year. In these two cases, and in a third of similar nature, the urine was of uniform character: it was copious (three or four pints daily), of low density, slightly mixed with blood, and slightly albuminous; the renal derivatives were devoid of fat, and comparatively scanty throughout the convalescence. It sometimes happens, however, that during recovery from acute Bright's disease, the renal epithelium and casts are found slightly fatty, and if the case should come under observation for the first time at this stage it may simulate chronic Bright's disease and prove very embarrassing for the prognosis.

There may be certain deviations from the usual course and symptoms of the disease; thus, although anasarca commonly appears first in the face, under the eyes, and afterwards invades the trunk and extremities, it may show itself first in the feet, hands, or scrotum; or œdema may appear in all parts of the body simultaneously. The effusion may also shift its seat from time to time, or it may induce the sudden accession of alarming or fatal symptoms from its being poured out in disproportionate abundance in certain localities, such as the lung, pleura, and submucous tissue of the glottis. Moreover, though the anasarca usually disappears some days or weeks or even many months before the urine is free from albumen, the converse sometimes obtains, especially in individuals of lax frame and anæmic tendency; such cases are apt to mislead if seen for the first time, after the albumen has disappeared from the urine—careful inquiry into the patient's previous history will elicit their true nature.

COMPLICATIONS.—These are chiefly comprised under two groups, viz. secondary inflammations of the serous membranes and the lungs, and a series of nervous phenomena known under the name of uræmia.

Secondary inflammations are much more common in the later stages of chronic Bright's disease than in the acute form: of these, pericarditis, although rare, is the most certainly fatal. Pneumonia is more common, and is also frequently the immediate cause of a rapidly fatal issue. Pleurisy and peritonitis, though less lethal, are not unfrequent, while bronchitis is almost invariably present. Should the anasarca become excessive there may be inflammation or even mortification of the integuments of the legs.

The uræmic phenomena have been at-

tributed to the retention in the blood of the excrementitious matters of the urine; they usually follow an excessive diminution or suppression of the urine from increasing obstruction in the kidneys. They consist in a train of nervous symptoms—headache, vomiting, diarrhœa, convulsions, coma—the consideration of which will be postponed till we come to discuss uræmia in connection with Bright's disease generally.

Etiology.—Acute Bright's disease, though not absolutely confined to any age, occurs in the immense majority of cases during childhood and youth. As a rule, the persons attacked have previously been in good health; in two instances, however, I have seen the disease complicated with acute pulmonary tuberculosis.

The exciting cause is usually some definite exposure to cold (such as lying or sleeping in a damp bed or on the damp ground, sitting in wet clothes, or in a current of cold air, or drinking cold water when in a state of perspiration) or a fit of intemperance. A large proportion of the cases are sequelæ of scarlet fever or, much more rarely, of some other zymotic disease; while, in some other instances, the affection is the result of pregnancy; it may also be caused by deficiency of food, with fatigue and mental anxiety.

Diagnosis.—During the height of the attack the symptoms and the changes in the urine are so unequivocal that the disease can hardly be mistaken for any other. But when the pyrexial stage is past, and the case becomes protracted, there is often great difficulty in determining whether we have to deal with the declining periods of an acute and curable disorder, or with a disease which has lapsed into the chronic and irremediable state, or with a disease which has been chronic throughout. The recent and curable forms are generally distinguished by the presence of blood and renal epithelium in the urine, by the absence of fat in the discharged elements, and by the absence of long-standing complications, such as hypertrophy of the left ventricle, phthisis, caries, necrosis, and joint disease. It is important to consider carefully the previous history of the patient and the ostensible cause of the disorder; the less clearly a case can be traced to a definite exposure to cold, to a fit of drinking, or to scarlet fever or some other zygmotic disease, the more reason *pro tanto* is there to fear that confirmed Bright's disease is established.

Prognosis.—The prognosis is generally favorable; a large majority of the cases undoubtedly recover. Frerichs reckons the recoveries as two-thirds of the individuals attacked; but probably this proportion is below the truth if the scarlatinal cases be included; we are still in want of precise data on the point. The prognosis is decidedly more favorable in the aged than in the young; I have several times seen the disease in persons over sixty, and once in a man on the verge of eighty; in most of these it proved mild, and in all eventuated in recovery.

Recovery cannot in any case be considered complete until the urine has become perfectly free from albumen. The anasarca may totally disappear, and blood cease to tinge the urine; the quantity of the secretion may increase considerably, the pyrexia pass away, and the general condition of the patient be greatly improved, but if a considerable amount of albumen continues to appear in the urine, there is great ground for apprehension that the disease is lapsing into a chronic state, or that the amendment is but a temporary lull in the symptoms, to be followed at no distant period by an exacerbation which shall prove more disastrous than the original attack. The worst consequences are to be feared if the urine become progressively scantier, of higher density, and more abundantly charged with albumen, tube-casts, and renal epithelium. The advent of inflammatory complications, of œdema of the lungs or glottis, and, above all, of decided signs of uræmic poisoning, are of equally evil augury, and leave but slender hopes of ultimate survival.

Treatment.—The double indication of treatment is to relieve the kidneys and to promote the action of the other excretory organs. If the case is seen at the onset the patient should be at once confined to bed, swathed in flannel, and made to lie between the blankets. The loins should be immediately cupped to eight or twelve ounces if the patient be an adult, to two or three ounces if a child. Abstraction of blood must be cautiously practised, however, on account of the tendency to anæmia in the later periods of the attacks. If the patient's health is broken by previous disease or if he is constitutionally weak, even local depletion is better avoided. If severe headache, coma, or convulsions occur, the cupping may be repeated. In threatening cases where the fever runs high, venesection may be practised in sthenic cases. After the abstraction of blood, a large hot linseed-meal poultice should be applied to the loins and renewed every three hours. The action of the skin should be promoted by the use of hot-air or hot-water baths; if no convenience for these exist, the "blanket-bath" forms an excellent substitute. Of medicinal diaphoretics, citrate of potash draughts given in effervescence every two hours, or a mixture of two or three drachm doses of liq. ammon. acet. with fifteen drops of tinct. hyoscyam. in

one ounce of infus. lini are very serviceable. Dr. Barlow recommends ¼ to ⅛ gr. of tartar emetic; I have employed it every four hours with the best results. Dr. Johnson speaks highly of antimonial wine, sometimes combined with Dover's powder. The bowels should be freely acted on every other morning by an active purge, such as the compound jalap powder. The use of mercury is objectionable, on account of the extreme susceptibility of patients with Bright's disease to the physiological effects of the drug. Severe salivation sometimes follows very small doses; in one of my patients profuse ptyalism was produced by two grains of blue pill with extract of colocynth taken on two alternate mornings.

Objections have been made, on theoretical grounds, to the use of the saline diuretics (acetate and citrate of potash) in acute Bright's disease; experience has proved, however, that they may be employed with great advantage. In a considerable number of cases of acute Bright's disease coming under treatment early, I have almost invariably obtained the best results by the free administration of citrate of potash; and in no instance where the urine has been rendered alkaline in the first week of the disorder have I observed the more severe uræmic symptoms or secondary inflammations. This remedy, however, has proved inefficacious in my hands when the fever has entirely subsided while the urine remains bloody and albuminous. Digitalis may be freely employed in any stage. Sir R. Christison recommends one- or two-grain doses of the powder in a pill, or ten to twenty minims of the tincture of digitalis combined with about two drachms of cream of tartar daily in five ounces of water—he considers this combination superior to either remedy given singly. Digitalis may also be applied externally in the form of cloths steeped in the infusion and laid over the abdomen. Dr. Dickinson attaches considerable importance to the free administration of water as a diuretic to facilitate the elimination of the urinary solids by the kidneys and so diminish the risk of uræmia. The diet should consist of light farinaceous substances with milk, beef-tea, and broths; flesh meat in any form should be avoided in the early stages. On the subsidence of the fever and the gradual diminution of the anasarca we may discontinue the more active measures, but the action of the skin should be carefully promoted. When convalescence has been fairly established, iron may be cautiously substituted for the alkaline and diaphoretic remedies. When tolerated, iron acts very beneficially and hastens in a marked manner the disappearance of blood and albumen from the urine; but it must be remembered that when begun too early, the preparations of iron are apt to induce a return of the acute symptoms. Hamburger[1] speaks strongly in favor of quinine in scarlatinal dropsy after the pyrexia has abated. He gives to children 1½ or 2 grains, and to adults 3 to 4 grains twice a day. Of forty-seven severe cases thus treated, he obtained amendment in forty-four either immediately or in a few days. My experience leads me to conclude with Dr. Parkes that gallic acid exercises no beneficial influence in the acute disorder.

Patients continue liable to relapses for a considerable time, the slightest exposure being sometimes sufficient to induce the reappearance of the pyrexia, and of the albumen and blood in the urine. A complete suit of flannels is therefore essential, and, as a rule, the convalescent should not be allowed to leave his room until the albumen has disappeared from the urine. When this has taken place, or even before, if the case prove very lingering, change to a warm, sheltered locality is likely to prove highly beneficial.

The secondary thoracic inflammations present great difficulty in their management. They usually set in at a period when antiphlogistic measures cannot be borne, and they run their course with unusual severity and rapidity. Counter-irritants and revulsives may, however, be energetically employed, always avoiding cantharides and turpentine on account of their specific irritating effect on the kidneys. Dry-cupping over the chest is frequently of great service.

In the obstinate vomiting which sometimes prevails, creosote or small doses of chloroform in iced solutions may be given. The special treatment of uræmia will be considered in the article on chronic Bright's disease.

(B.)—Chronic Bright's Disease.

Morbid Anatomy.—Three chief types of alteration are found in the kidneys of persons who have died of chronic Bright's disease, viz.: I. *Kidney smooth, white,* and enlarged; rarely in extreme cases atrophic (chronic nephritis). II. *Kidney granular,* brownish or red, and contracted (cirrhotic kidney). III. *Kidney lardaceous or waxy* (so-called amyloid degeneration). These types are not always found pure and simple, but, on the contrary, the main type is often complicated with superadded changes belonging to another type: thus the smooth white kidney becomes not unfrequently affected with waxy degeneration, while the granular and waxy forms are both liable to inflammatory attacks leading to changes belonging to the first

[1] Prag. Vierteljahrschr. 1861.

type. The clinical history as well as the anatomical condition is thus rendered complex.

I. *Smooth White Kidney.*

In this form the structural changes are essentially similar to those described as occurring in acute Bright's disease, but advanced to a further stage; the surface continues perfectly smooth, and presents conspicuous stellate patches of bloodvessels; the capsule is thin and easily stripped off; the organ is considerably enlarged, and on section the cortical substance is seen to be greatly increased, and to have an ivory-white appearance; or, if fatty, it is yellowish. The cones retain their usual color, but appear conspicuously red from contrast with the abnormally white cortex.

The microscopic changes are essentially limited to the uriniferous tubes, which are distended and enlarged from the enormous increase of their epithelial lining; they sometimes contain transparent fibrinous exudation and blood. The cells are swollen, generally opaque and granular, and often loaded with oil. As the disease progresses, many of the tubes and their contents are broken up into a granular debris and absorbed. The intertubular stroma is, in typical examples, unaffected. The Malpighian corpuscles are but slightly, if at all, enlarged: their capsule is thin as in the natural kidney. The cones undergo changes analogous to those in the cortex, but less developed; fibrinous casts sometimes occupy the interior of the straight tubes.

The large smooth kidney generally remains large and smooth to the last; but in some cases, if the patient survive for some years, a progressive dwindling takes place, so that in extreme cases the kidney may not weigh more than an ounce, if so much. When atrophy has taken place, the capsule is somewhat thickened and adherent, and slight depressions are seen on the renal surface, giving the organ a slightly granular character. This atrophic condition, which Dr. Dickinson states is usually due to the superaddition of amyloid changes, seems to be produced by a destruction and gradual absorption of the distended tubules and their epithelial contents, leading to progressive disappearance of the cortex while the pyramidal portions remain intact. The bloodvessels are much thickened, and, according to Dr. Grainger Stewart, there is a relative increase of the fibrous stroma—much less, however, than in the cirrhotic kidney.

The large white kidney is not unfrequently the subject of fatty change, especially when the disease has arisen from cold; it constitutes one form of the "fatty kidney," and though this change may begin at an early stage of the disease, it only reaches an extreme degree in long-standing cases. When this condition is present, oily particles are found in great numbers in the epithelial elements, and lying free in the tubules.

Synopsis of Symptoms and Conditions of Origin.—The smooth kidney is found in those cases in which chronic Bright's disease has followed on the acute disorder. The invasion of the disease has been sudden, and it can usually be traced to some definite exciting cause, either cold or scarlatina. I have also found the large white kidney in chronic Bright's disease following repeated pregnancies, and in a case arising in the course of phthisis.

The average age of 106 cases of smooth large kidney examined by Dickinson was 28·2 years; in eleven cases of smooth dwindled kidney it was 43·6 years; while in 250 cases of granular kidney it was 50·2 years.

The urine is generally scanty, of normal or slightly above the normal specific gravity, pale and cloudy—sometimes smoky and tinged with blood. On standing, it deposits a quantity of amorphous renal debris and tube-casts of various character—"epithelial," "fatty," "granular," and "hyaline." Cells resembling pus-corpuscles are common towards the later periods. Dropsy is an almost invariable coincident: the face is pale and puffy, and the cutaneous surface conspicuously white, smooth, and glossy. There is a markedly greater tendency to secondary inflammations and to uræmic accidents, but less to valvular heart disease and hypertrophy of the left ventricle, than in granular kidney.

The disease is of shorter duration than in granular kidney; in fatal cases the usual duration is under six months. But exceptional cases occur in which its course extends over several years. In these protracted cases the albuminuria continues long after the disappearance of the dropsy. I have known cases in which abundant albuminuria has persisted for more than a year after all other symptoms of disease had ceased; at length the albuminuria has gradually disappeared, and health been re-established.

Permanent recovery is not impossible after the lapse of a year or more.

II. *Granular Contracting Kidney.*

Synonyms.—Granular Kidney; Cirrhotic Kidney; Gouty Kidney; Intertubular Nephritis; Interstitial Nephritis.

The organ is diminished in size and reduced in weight—in extreme cases to two or three ounces or less. Its surface is

rough and studded with numerous rounded elevations, varying from the size of a pin's head to that of a small pea. The capsule is opaque, thickened, and adherent to the subjacent surface, so that it cannot be stripped off without tearing the grandular structure; in places it dips into the cortical substance and divides the kidney irregularly, giving it a lobular appearance. On section, the cortex is manifestly atrophied, as compared with the cones, and forms around the bases of the pyramids a thin rim, only a line or even less in thickness; it has a red or brownish-red color, and a coarse granular texture. The entire organ is tough and resistant. In the rare cases in which the granular kidney is met with in its early stage, thickening of the capsule and slight granulation of the surface are found to precede contraction, so that at this period the organ preserves its normal volume. In the contracted stage, the granular kidney allows injections to penetrate imperfectly. This diminished permeability is not entirely due to the cirrhotic state of the intertubular matrix, but partly, as Johnson has pointed out, to thickening of the walls of the minute arteries of the kidney.

On microscopical examination, the secreting tissue is found to have undergone extensive destruction. The Malpighian bodies are shrunk to half their size and abnormally crowded, their vascular tufts being embraced in a fibrous and granular investment, and, in extreme instances, compressed into an impermeable knot at the bottom of their capsules. Some of the uriniferous tubes are denuded of epithelium and reduced to mere tubular threads; some, also denuded, contain glassy fibrinous cylinders, while others are packed with broken-up epithelium. Both the fibrinous exudation and the disintegrated epithelium sometimes contain oil, but not so commonly nor so abundantly as in the smooth kidney. Comparatively normal tubes lined with healthy epithelium may be found side by side with tubes thus altered. A large quantity of adventitious connective tissue lies between the wasted structures, giving the organ its peculiar toughness.

According to Dr. Johnson, the morbid process begins in the epithelial cells, but Dickinson and Grainger Stewart describe it as originating in the intertubular matrix, and as consisting essentially in an enormous hypertrophy of the fibrous stroma of the organ. By the pressure and contraction of this fibrous material, the tubes and Malpighian corpuscles are extensively destroyed, and the size of the kidney is progressively reduced. According to Dickinson, the fibrous growth begins beneath the capsule and then penetrates into the interior of the cortex—the points where these fibrous processes penetrate are depressed, and if these are numerous and distributed with tolerable regularity, an appearance of superficial granulation is produced. The disease thus travels from the surface, and eventually involves the pyramids. Cysts are very commonly met with in the granular kidney. They vary in size from a pin's head to a hazel-nut, but many are so minute that they can only be detected by the microscope. Mr. Simon believes that they are formed by an immense dilatation of epithelial cells. The generally received and much more probable view, however, is that they are produced by obstruction of the uriniferous tubes with exudation, at intervals, or by compression of their walls at interrupted spots by the contracting adventitious tissue. The spaces thus inclosed become distended with a serous fluid and are sometimes found lined with an epithelial layer. Their contents are not urinous, but consist of an albuminous saline solution. They occur both in the cortex and in the cones: in the cones they are sometimes elongated and placed end to end like a string of sausages (Dickinson).

Synopsis of Symptoms and Conditions of Origin.—The granular kidney is found in the majority of those cases of Bright's disease which are chronic from the beginning—which commence insidiously and without definite exciting cause. The disease may run a latent course for months or years. The subjects of it are more advanced in years than those of the smooth large kidney. The urine is copious—three or four pints a day—and of low density; towards the termination of the disease, however, it becomes scanty, or even suppressed. The quantity of albumen is comparatively small; in rare cases it may be temporarily absent. There may be no deposit in the urine, or it may be so scanty as to escape detection; when present, it is slight, composed of hyaline and granular casts, with very slight admixture of epithelium, and rarely fatty. As a rule blood is absent.

In a quarter to half the cases there is no dropsy; when present it is commonly slight and limited to œdema of the ankles and legs, or puffiness under the eyes: it may disappear for a time, and then return. The cutaneous surface, though pale and anæmic, has not the conspicuous whiteness noticed in the preceding type; the features are often pinched and sallow. Cardiac hypertrophy is a very frequent concomitant, and a rooted constitutional cachexy is very often present.

The common predisposing causes are habitual intemperance, gout, lead-poisoning, repeated exposure to cold, and extensively distributed atheromatous degeneration of the tissues.

As the two types which have just been described comprise the vast majority of cases of Bright's disease, much discussion has taken place as to whether Bright's disease is a single or a multiform affection —whether the smooth large white kidney merges into the granular red contracting kidney, or whether they remain distinct affections throughout. Reinhardt, Frerichs, Rosenstein, and German observers generally, take the former view, while the latter has been placed beyond reasonable doubt by the labors of Johnson, Wilks, and Dickinson in this country. It is of course admitted that the large white kidney may become atrophic, and Johnson, Dickinson, and Grainger Stewart adduce several examples of such a change, but they insist that in its further stage of contraction the smooth dwindled kidney is still distinguishable from the granular red kidney.

Of twenty-six fatal cases of enlarged white kidney observed by Johnson, there was dropsy in twenty-four, or 92 per cent.; whereas, in thirty-three fatal cases of contracted kidney, dropsy was present only in fourteen, or 42 per cent.; hence he pertinently observes, "It is difficult to understand how it can happen that the majority of those patients who have reached the final stage of renal degeneration should escape the dropsy, which, in a greater or less degree, troubles nearly all those who die in what is assumed to be an earlier stage of the same disease."[1] Again, convulsions and secondary inflammations, as pneumonia and peritonitis, are more frequent with the smooth kidney; whereas, hypertrophy of the left ventricle, atheroma, and apoplexy are more frequent with the granular kidney.

III. *Lardaceous or Waxy Kidney.*

Synonym.—Amyloid Degeneration.

The organ is usually enlarged, sometimes diminished, smooth, or slightly roughened, and markedly tough and hard; the capsule peels off readily. On section, the cortex is bloodless, of a white or yellowish color, with a smooth, waxy, translucent appearance, resembling bacon-rind; on the smooth cut surface little appearance of the natural secreting structure is seen, but it is dotted over with bright glancing points: these are the changed Malpighian bodies. The cones appear unnaturally red and distinct. This description applies only to extreme degrees; when slighter, the nature of the change can only be determined by means of the microscope or by applying a solution of iodine. When a thin section is highly magnified the waxy material is seen to affect mainly, sometimes exclusively, the bloodvessels. The deposit invades primarily the muscular coat of the arteries, which it renders abnormally transparent and thick, thereby diminishing the lumen of the vessel. The Malpighian corpuscles are earliest attacked; they appear as shining particles with thickened capsules; their vascular tufts are infiltrated with the waxy material. In advanced cases, the vasa afferentia with the arteries and capillary network of the cortex, and even the vessels of the pyramids, are similarly changed. The epithelial cells of the uriniferous tubes are commonly withered, often infiltrated with fatty molecules, but they do not appear to undergo the true lardaceous change. Hyaline-casts exist in some of the tubules. The stroma of the gland is much increased in quantity, but is not lardaceous.

The proper test for waxy degeneration is a watery solution of iodine, which imparts to the affected portions a deep mahogany brown color, whereas the unaffected parts acquire a yellowish tinge only.

The liver and spleen are usually enlarged and lardaceous when the kidneys are so affected. Of seventy-seven cases collected by Rosenstein, the three organs together were affected in forty-eight, the spleen and kidneys in twenty, the liver and kidneys in four, and the kidneys alone in five cases.

The chemical nature of the waxy material has only recently been investigated. Virchow concluded that it belonged to the same group as starch and cellulose, because like them it yields a violet color with iodine and sulphuric acid. But the analyses of C. Schmidt and Kekulé show that it contains nitrogen, and in almost exactly the same proportions as the protein compounds. It further resembles albuminous compounds in yielding a violet color with the cupro-potassic solution, in dissolving completely in dilute caustic potash, and in being precipitated from this solution in white flocks by acids. The proportion per cent. of carbon, hydrogen and nitrogen found by Kekulé in purified waxy matter from an exquisite specimen of lardaceous spleen was C. 53·58, H. 7·00, N. 15·4—which corresponds closely with the percentage of the same elements in albumen. Dickinson considers it a variety of fibrine, but differing from ordinary fibrine in containing about one-fourth less alkali and a somewhat larger proportion of earthy salts.

Synopsis of Symptoms and Conditions of Origin.—Waxy degeneration of the kidneys always comes on insidiously and in cachectic persons debilitated by some pre-existing wasting disease. In

[1] Med.-Chir. Trans. vol. xlii. p. 156.

145 instances collected by Fehr, it coexisted with pulmonary tubercle in forty-three, with syphilis in thirty-four, and with caries and struma in twenty-six cases.[1] The course of the disease is essentially chronic.

The urine in the earlier stages is markedly copious—60, 100, and even 200 ounces per day. Dr. Grainger Stewart has pointed out the important fact, which my own experience fully confirms, that this polyuria is a marked feature, even before the urine becomes albuminous, and that this supplies a warning of the advent of this form of Bright's disease. As the disease advances the urine becomes scantier and of higher density, and the proportion of albumen, at first small, becomes very great. The color of the urine is usually pale; there is a very scanty deposit which consists of casts and atrophied renal cells, which are sometimes fatty. Cells resembling pus-corpuscles are occasionally found either separate or aggregated round a cast. The tube-casts are usually hyaline, and do not yield a brown coloration with iodine: epithelial casts are also sometimes seen. Münch found corpora amylacea constantly present in the urine of a man with waxy kidney: they were colored violet by iodine and sulphuric acid. Dropsy is present in the majority of cases: Fehr found it in 98 out of 152 cases collected by him: in some it is abundant and general, in others slight and partial. Uræmic symptoms are strikingly infrequent.

The diagnosis of waxy kidneys rests partly on the coincidence of a pale abundant albuminous urine with dropsy, but chiefly on the coexistence or pre-existence of one of the wasting diseases of which waxy kidneys are known to be a frequent complication, viz., phthisis, caries, long-continued suppuration, and constitutional syphilis.

General Course and Symptoms of Chronic Bright's Disease. — In the great majority of instances chronic Bright's disease begins slowly and imperceptibly. The attention of the patient is awakened, some months, or it may be years, after it has existed, by the gradual failure of his strength and his increasing pallor or sallowness, with disinclination to exertion; or his suspicions are aroused by a little puffiness under the eyes, a slight swelling of the ankles at night, unusually frequent calls to void urine, or shortness of breath. In other cases these premonitions pass unheeded or are altogether wanting. The disease proceeds silently, amid apparent health, and then suddenly declares itself by a fit of convulsions, rapid coma, amaurosis, pulmonary œdema, or a violent inflammation; or it may lie concealed for an undetermined period, and then reveal itself, after exposure to cold or a fit of intoxication, in the guise of an acute attack, with rapid general anasarca and scanty sanguineous urine; or it may be a continuation or sequela of acute Bright's disease; or, lastly, it may creep on stealthily in the wake of some pre-existing chronic disorder —phthisis, caries, necrosis, constitutional syphilis, gout, chronic alcoholism, or exhausting suppuration.

The principal symptoms of the disease are: albuminous urine with deposits of tube-casts and renal epithelium; frequent micturition, especially at night; dropsical effusions into the subcutaneous cellular tissue, serous cavities, or pulmonary substance; dryness of the skin; derangements of digestion; progressive hydræmia; uræmic phenomena (headache, amblyopia, convulsions, coma, vomiting, and diarrhœa); hypertrophy of the left ventricle; secondary inflammation of the parenchymatous organs and serous membranes.

Few cases present the whole of these symptoms: many present only two or three of them. The alterations in the composition of the urine are the most invariable, and also the earliest and most distinctive symptoms; next follow in the order of constancy, the deterioration of the blood, the dropsical symptoms, and, lastly, the uræmic and inflammatory incidents.

The disease usually pursues an interrupted course, being subject to occasional exacerbations, with intervals of quiescence. The exacerbations are generally induced by exposure to cold or some imprudence in diet or regimen; sometimes no cause can be assigned for their occurrence. They are marked by pyrexia, and often simulate an attack of acute Bright's disease. The intervals of quiescence may be some weeks or months, or a few years; the remission of the symptoms is commonly only partial, the main features of the disease persisting, though in a modified degree. Sometimes, however, the remission is almost complete, and little except the albuminous state of the urine remains to attest the existence of renal mischief; and even this may, in exceptional cases, be absent, and the nature of the case be first revealed at the autopsy. After each exacerbation it is commonly pretty evident that the disease has progressed a step, and that probably an additional portion of the kidney, hitherto spared or only slightly affected, has been disabled. The kidneys are at length so seriously disorganized, and their depurative functions so far abrogated, that life becomes impossible.

The immediate cause of death is varia-

[1] A. Fehr, Ueber die Amyloide Degeneration, insbesondere der Nieren, Bern, 1867.

ble. Sometimes the sufferer passes quietly away, exhausted by anæmia, burdensome anasarca, and defective digestion. About one-third of the subjects of chronic Bright's disease perish by uræmic poisoning, either in the form of coma and convulsions, or irrepressible diarrhœa and vomiting. A considerable number die from the intensity or dangerous situation of the dropsical effusion, as when the glottis or lungs are invaded; or death results from hydrothorax, or from gangrenous erysipelas set up in the tense œdematous integuments of the legs, thighs, or genitals. About one-fifth die by secondary pneumonia, pericarditis, or double pleurisy. The remainder are cut off by more remote complications, as apoplexy, cirrhosis, phthisis, intestinal ulcerations, &c.

The *duration* of the disease can only be approximately ascertained from the difficulty of assigning the exact date of invasion. Enough is, however, known to show that it varies within very wide limits. The usual period is from two to three years; but cases may end in six months, or be protracted for four or five years. Exceptional instances have been recorded in which patients have survived ten years and even fifteen and twenty-three years.

Particulars of Symptoms and Complications.—*Urine.*—The quantity of albumen is most variable. The urine may become absolutely solid on boiling—or it may contain only the minutest traces of albumen, even in confirmed and fatally-tending cases. The amount of albumen lost in twenty-four hours varies commonly from 45 to 300 grains; Dr. Parkes observed in one instance 545 grains. During digestion the quantity is larger (it may be double) than during fasting; it rises and falls irregularly in the course of the disease, sometimes diminishing to a trace, and anon increasing to an intense impregnation.

The urine is generally pale and slightly turbid, depositing, on standing, an amorphous whitish sediment of renal epithelium and tube-casts. It sometimes contains blood—occasionally in quantity, but generally in microscopic proportion. When there is intercurrent pyrexia or the case is complicated with phthisis or regurgitant heart disease, the urine may be high-colored and turbid from lithates.

The quantity of urine voided per diem varies with the type of the disease, and the presence or absence of pyrexia, sweating, vomiting, or diarrhœa. The specific gravity is low when the urine is copious (1006 to 1015); but when scanty, the specific gravity may rise to 1030 or even 1040. The urine is nearly always acid, and not unfrequently deposits uric acid and oxalate of lime; occasionally I have noted it alkaline from fixed alkali, and on two occasions ammoniacal on emission.

The *renal derivatives* (see Figs. 89, 90, 91) are markedly scantier in chronic than

Fig. 89.

Transparent casts. *a a.* From the urine of a man with chronic Bright's disease of eight months' duration (urine bloody, intensely albuminous, anasarca, dying from pneumonia); *b b.* from a case of chronic Bright's disease (large white kidney); *c.* from a case of chronic Bright's disease (contracted kidney with fatty degeneration).

in acute Bright's disease; they are not unusually entirely absent for limited periods. They are, however, sometimes discoverable when the urine has temporarily ceased to be albuminous. The epithelial cells may be simply withered; more rarely they are totally disintegrated into an amorphous granular debris; in

other cases they contain specks of oil, or they may even be wholly converted into an agglomeration of oily particles, so as to appear identical with the "granular corpuscle" or "inflammation globule." If the casts are similarly speckled with fat, and free oily dots are scattered over the field, it indicates a fatal disorganiza-

Fig. 90.

a a. Fatty casts; *b b.* blood-casts; *d d.* free fatty molecules.

tion of the organs—either large fatty kidneys or contracted granular ones. Considerable diversity in the character of the casts discharged by the same individual, even during the same day, may be met with, arising from the different condition of the several parts of the gland: conclusions as to the probable state of the kid-

Fig. 91.

Casts and renal cells from a case of contracting granular kidneys; *a a.* granular opaque casts; *b b.* hyaline casts; *c d.* fatty masses.

ney can only be drawn from the *prevailing* character of the deposit, and not from one or two individual casts or cells. The casts *most commonly* seen in chronic Bright's disease are "small" and "large" hyaline forms and "granular" opaque ones, any of which may have a few wasted epithelial cells strewed over them. Per-

fect "epithelial" casts are rare; blood casts are also rare, in chronic cases, unless there be concomitant tricuspid regurgitation. Large hyaline casts result from the exudation having been thrown into tubuli denuded of their epithelium; while if these have subsequently undergone contraction, the casts will be small and hyaline. Other tubuli, clothed or partially clothed with epithelium, shed some of their cells with the contained exudation, and cause the appearance in the urine of casts more or less studded with epithelial remnants. The longer the exudation is retained within the tubuli, the darker and more granular the casts; and *vice versâ*, casts speedily discharged are commonly hyaline. Sometimes casts are darkened by the coloring matter of the blood; and the opaque granular ones are sometimes composed of crushed epithelial debris moulded into the form of the tubuli.

The normal solids of the urine are all diminished in chronic Bright's disease. The urea is, as a rule, markedly reduced, the daily quantity averaging only about 100 grains; Frerichs has observed it as low as 15 grains. A case is mentioned by Mosler,[1] however, in which 640 grains were voided in one day! There is no correspondence, direct or inverse, between the urea-excretion and the discharge of albumen. With intercurrent pyrexia the excretion of urea increases.

Blood.—The changes in the blood are the complement of those in the urine; it becomes more watery and poorer in albumen and red corpuscles, while urea, uric acid, extractive matters, and pale corpuscles are relatively increased. This alteration in the composition of the blood is deeply concerned in the production of the more prominent features of the disease—the anæmia, dropsical effusions, uræmic phenomena, and secondary inflammations.

Dropsy is much oftener absent in the chronic than in the acute form. It is much more constant with the smooth large than with the granular contracted kidney, of which probably one-third or one-fourth of the cases run their entire course without dropsy. The effusion begins quite as often in the feet and legs as in the face, and is apt to change its seat capriciously; sometimes it is excessive and general, but usually slight and partial. When the heart or liver is diseased, ascites and œdema of the legs become unduly prominent. The effusion may disappear totally for months, and then return; more frequently, after the subsidence of the general dropsy, œdema lingers obstinately in one or two places—over the flat of the tibiæ, about the ankles, beneath the eyelids, under the conjunctiva, or about the genitals. The presence or absence of dropsy generally, but by no means always, corresponds with the abundance or scantiness of the urine; but it has no relation to the amount of albumen.

The skin is usually obstinately dry; perspiration is quite exceptional, and is commonly due to diaphoretic treatment. Profuse sweating does, however, sometimes take place spontaneously, and may even continue for weeks; in one such case under my care an abundant crop of pemphigus bullæ appeared. The integuments in some cases are excessively pale and glossy, more commonly sallow and rough. There is little or no tenderness in the renal region in the chronic cases, and the frequency of micturition is mostly observed at night. Some degree of bronchitis is almost an invariable coincident in both acute and chronic Bright's disease.

Complication and connection with other diseases.—The digestive organs are nearly always disturbed: at first there is anorexia and nausea, and later, frequent or even uncontrollable diarrhœa and vomiting are not unusual. In some cases these symptoms are obviously of uræmic origin; but not unfrequently anatomical lesions—follicular catarrh, dysenteric ulcers, sometimes with sloughing of the mucous membrane—are found in the intestines, which explain these disturbances. Treitz states that urea is discharged into the intestines from the blood, and being converted into carbonate of ammonia, acts as an irritant on the intestinal mucous membrane. In 220 cases of Bright's disease, collected by him, the following conditions of the intestines were found after death: Hydrorrhœa (intestines filled with yellow-greenish fluid) in 80; blenorrhœa and catarrh in 60; croupous and ulcerous dysentery in 19; sloughing in 12; sanguineous contents without discoverable source of hemorrhage in 4; normal feces in 5; and contents of intestines undetermined in 11 cases.[1]

[Semmola[2] insists that true Bright's disease is always connected with, or consists in, a general nutritive disorder, to which the affection of the kidneys is secondary. This disorder begins, according to his statement, in an arrest of *cutaneous respiration*. Next follows imperfect digestion and transformation of albuminoid food; and the presence of an excess of albumen, with deficient formation of urea, in the blood. Hence result renal irritation and inflammation, albuminuria, and diminished excretion of urea. At a later period, when the kidneys have undergone considerable morbid alteration, the se-

[1] Archiv d. Vereins, Bd. xi. p. 513.

[1] Prag. Vierteljahrschr. 1859.

[2] Gazette Médicale de Paris, 1875; quoted in Brit. Med. Journal, Sept. 27, 1879.]

creting structure fails to eliminate the urea which is formed. Then, and not before, will uræmia take place. Semmola considers that pathologists have generally too much neglected the *dyscrasic* character of Bright's disease, and its special dependence (being thus set apart by him from albuminuria of other causation, *e. g.*, alcoholism, gout, &c.) upon the gradual action of cold upon the skin.—H.]

Secondary inflammations of the lungs, endocardium, pericardium, pleura, peritoneum, or integuments may break out at any period in the course of Bright's disease, and the tendency to these constitutes one of the principal dangers of the complaint.

Cardiac hypertrophy, valvular disease, and pulmonary tubercle are frequent complications.[1]

Bright's Disease and Phthisis. — This complication is of frequent occurrence. In the great majority of cases the pulmonary disease is far advanced before renal symptoms appear, the long-continued discharge of pus from the lungs at length giving rise to waxy changes in the kidneys, followed by albuminuria and dropsical effusion. But sometimes the renal disease precedes the pulmonary, and the changes found in the kidneys after death are not invariably of the waxy type.

The coexistence of two fatally-ending diseases might have been expected to accelerate the inevitable issue; yet most of these cases run an exceedingly chronic course, continuing *in statu quo* for months together. In a case recorded by the writer, the pulmonary disease already in its third stage completely retrograded, and was supplanted by the renal affection.[2]

Bright's Disease and Diseases of the Heart and Vascular System.—The connection of cardiac disease with renal disorder is at least threefold.

1. *Simple hypertrophy of the heart*, especially of the left ventricle, is found without valvular incompetency and without degeneration of the muscular fibres. In this numerous class the cardiac is secondary to the renal affection. Bright, who was the first to point out this curious coincidence,[3] offered two explanations of it—that the altered composition of the blood either exercised an irregular and unwonted stimulation upon the muscular tissue of the heart, or so impeded the circulation in the capillaries that a greater effort of the ventricle was required to propel the blood through them. Traube believes it to be a conservative or compensating change, similar in its production to that induced by valvular incompetency or aortic constriction. He brings forward evidence to show that hypertrophy of the left ventricle is an almost constant concomitant of granular, contracted kidney. The destruction of secreting structure in these organs leads to the diminution of the amount of blood passing from the arterial into the venous system, and of the quantity of fluid withdrawn from the arterial system for the formation of urine. Both circumstances, but especially the second, operate to increase the tension in the arterial system, and consequently to increase the resistance which the left ventricle has to overcome in discharging its contents. If the compensation be complete, the increased tension in the arterial system occasions a larger transudation of water, and even of urea and other urinary solids, through the kidneys, and so materially aids in warding off dropsical effusion and uræmic symptoms. But, as in some apposite examples adduced by Traube, should some additional obstruction to the circulation arise through intercurrent inflammation of the bronchial tubes or of the lungs, pleura, or pericardium, the heart, enlarged and strengthened though it be, no longer suffices to overcome the increased resistance, and uræmia or dropsical effusions speedily manifest themselves.[1]

Renewed interest in the connection between chronic Bright's disease and cardio-vascular changes has been awakened by recent researches. Dr. George Johnson discovered that there is a wide-spread hypertrophy of the muscular walls of the small arteries in chronic Bright's disease. He finds it not only in the arteries of the kidneys, but also in those of the pia mater, the skin, the intestines, and the muscles. He explains the production of this hypertrophy, and the manner in which it reacts on the left ventricle, as follows: "In consequence of the degeneration of the kidneys the blood is morbidly changed. It contains urinary excreta, and it is deficient in some of its own normal constituents. It is, therefore, more or less unsuited to nourish the tissues—more or less noxious to them. The minute arteries throughout the body resist the passage of this abnormal blood. The result of this antagonism of forces is, that the muscular walls of the arteries, and those of the ventricle of the heart, become simultaneously and in an equal degree

[1] For a table showing the proportionate frequency in 406 autopsies, with which the various organs, other than the kidneys, were found affected in Bright's disease generally, the reader is referred to the writer's work on Urinary and Renal Diseases, 3d edit. p. 413.

[2] Ibid. p. 414.

[3] Guy's Hosp. Reports, vol. i. p. 396.

[1] Ueber den Zusammenhang von Herz und Nieren-krankheiten, p. 58; and Deutsche Klinik, 1859, p. 315.

hypertrophied. The persistent overaction of the muscular tissue, both cardiac and arterial, is found registered after death in a conspicuous and unmistakable hypertrophy."[1] [A simpler (and, to my mind, more probable) explanation is, that the hypertrophy of the muscular tissue of the renal arterioles, and that of the left ventricle, are *both* produced in the manner suggested (as above mentioned) by Traube in regard to the heart; namely, by *increased resistance* to the passage of blood, through the defective secreting structure of the kidneys.—H.]

Sir William Gull and Dr. Sutton have brought forward a novel view of the pathology of granular kidney and of the associated changes in the cardio-vascular system. They believe that there exists in these cases a peculiar pathological change to which they give the name of "Arterio-capillary fibrosis." This consists in the deposit of a "hyalin-fibroid" material in the fibrous coats of the arterioles and capillaries. This change may prevail extensively throughout the vascular system, in the kidneys, skin, pia mater, heart, lungs, spleen, stomach, and retina. In its nature it is allied to, but not identical with, senile changes. It commonly begins in the kidneys, but it may begin elsewhere; so that hypertrophy of the heart, with degeneration of the arterioles, may be found associated with healthy kidneys; and that when atrophy with granulation of the kidneys exist, it is but part and parcel of a general morbid change. The granular form of Bright's disease is, in their eyes, essentially an instance of arterio-capillary fibrosis. These views have been sharply criticized, and are still in dispute, but they have the merit of bringing into true prominence what every observer of extended experience in cases of granular kidneys must have had strongly impressed on his mind—namely, that the renal affection is not a mere local affair, but that it is, rather, a part of a wide-spread tissue-degeneration involving the entire or a large portion of the body.

2. *Valvular defects* and their consequences frequently coexist with Bright's disease. Some of these are examples of endocarditis, secondary to the renal disease; but, in other cases, the cardiac and renal affections arise independently of each other; or they depend on some common cause, as in a case recorded by myself,[2] in which fatty degeneration had simultaneously invaded the heart, brain, and kidneys, giving rise to three distinct groups of symptoms.

3. In a third class are comprised all those cases in which the renal disorder is secondary and subordinate to cardiac disease. They are described in the article on Congestion of the Kidneys, to which the reader is referred.

[1] Lectures on Bright's Disease, p. 67.

[2] Op. cit. p. 421.

Uræmia.

The phenomena to which the term *uræmic* has been applied consist of twitchings and convulsions of the voluntary muscles, headache, drowsiness, coma, defects of sight and hearing, vomiting, and diarrhœa.

It is noteworthy that uræmic phenomena of a paralytic nature affect the sensorium and the special senses, but not the voluntary muscles; while those of an opposite kind (exalted irritability) affect the voluntary muscles, but not the sensorium. Delirium is rare, while coma is frequent; paralysis of the limbs is scarcely known unless there be some anatomical lesion of the brain superadded, while convulsions are frequent.

The mode in which uræmic symptoms appear and the forms they assume are very various. They generally begin insidiously with headache and vomiting, followed by heaviness, indifference, and somnolence. These premonitory symptoms may pass off in a few days, or they may be succeeded by general convulsions and coma. In other cases the patient is struck down with convulsions or insensibility without any previous warning, or he becomes suddenly blind, or is seized with uncontrollable vomiting.

Headache is the most common uræmic symptom; it is seldom continuously absent in degeneration of the kidneys. A sense of heavy weight or compression is complained of over the forehead or vertex, or there is obstinate pain at the back of the neck or behind the orbits.

Defects of Sight.—These consist either in amblyopia—a dimness of vision which comes and goes, objects appearing as if veiled in mist—or in rapid and complete, though usually transient, blindness. Temporary loss of sight often accompanies the convulsive seizures and usually persists for a time after they have passed off. The ophthalmoscope reveals no organic change in the eye in genuine uræmic amblyopia; it is purely cerebral, and not to be confounded with the hemorrhagic blindness (retinitis apoplectica), which is also common in Bright's disease, and in which the loss of sight, though seldom complete, is more permanent. The latter affection is due, as Von Gräfe has shown, to rupture of the retinal vessels, and is akin to the sanguineous apoplexy to which sufferers from Bright's disease are liable: its production is probably due to the hypertrophy of the left ventricle, which so commonly accompa-

nies a contracting kidney, and the increased arterial tension consequent thereupon.

Uræmic deafness is much less common than amblyopia; its occurrence is highly exceptional.

Uræmic convulsions conform closely to the epileptic type as a rule; they usually leave the patient comatose. In exceptional cases consciousness is not wholly lost. In a lady under my care the paroxysms coincided with the catamenial periods; during the convulsions the patient knew the persons about her, and called loudly to be held fast. Dr. Bright relates a case in which intelligence remained perfect, although the patient was in a state of convulsion, with forcible drawing up of the legs and distortion of the muscles of the face.

An attack of uræmic convulsions may consist of a single paroxysm, or, more frequently, of a succession of such paroxysms, following each other at uncertain intervals of a few minutes or hours, the patient during the remissions lying in a state of profound insensibility, with stertorous breathing, pale face, and dilated pupils; or in deep drowsiness, but capable of being partially roused when spoken to or shaken. If a first attack does not prove fatal, it may recur at irregular intervals of weeks or months, or be replaced by other uræmic symptoms.

Uræmic coma either comes on insidiously, passing into complete stupor in the course of two or three days; or the patient falls down as if in apoplexy, perhaps while walking in the street, or pursuing his usual avocation. When there is no anasarca, and the previous state of the urine is unknown, cases of this class are very liable to be confounded with apoplexy or with narcotic poisoning.

The *diagnosis* of uræmic coma from apoplexy rests on the absence, in the former, of paralysis and the partial recovery of consciousness between the convulsive attacks, if there be any. From ordinary epilepsy, the diagnosis is sometimes difficult, if there be no known antecedent history to indicate the nature of the case. The incidents of the seizures are often identical, even to the existence of an aura; but as a rule, the turgid purplish countenance and asphyxial character of true epilepsy are absent in uræmic fits, in which the face is nearly always deadly pale and the breathing easy. From opium-poisoning, renal coma is distinguished by the dilated or semi-dilated pupils, and by the occurrence of remissions in the insensibility. Dr. Richardson relates the cases of two children poisoned by belladonna berries, in which the symptoms closely resembled uræmic coma sequential to scarlatina; the insensibility was complete, and the pupils strongly dilated. The examination of the vomited matters and of the urine furnishes the best means of diagnosis in such cases.

In all cases of convulsions or insensibility from doubtful causes, the urine should be examined, and, if necessary, withdrawn by catheter for the purpose. It ought to be remembered that sanguineous apoplexy is not very unfrequent in chronic Bright's disease.

Uræmic coma and convulsions may occur separately; but much more commonly the attacks are of a mixed character, and combine several or all the phenomena just enumerated.

As a rule, the quantity of urine and the excretion of urea diminish notably immediately before a uræmic attack; but sometimes great scantiness of urine, or even, in acute Bright's disease, total suppression may exist without uræmic symptoms. Biermer relates a case of scarlatinal dropsy in which complete suppression of urine continued for five days without uræmia; for four days and a half afterwards a few teaspoonfuls a day were secreted, and yet no uræmia; after this the urine flowed abundantly for a short time, and then again became scanty: three days later uræmic coma set in, followed by convulsions, which proved fatal.

Uræmic vomiting and diarrhœa are common phenomena of Bright's disease, but the vomiting is not always uræmic, there being greatly impaired digestive powers throughout the disease. Genuine uræmic vomiting takes place without reference to the contents of the stomach, and is frequent or uncontrollable, the vomited matter being a watery fluid, either distinctly ammoniacal to the smell, or, if acid, evolving ammonia freely when caustic potash is added. The alvine dejections in uræmia are similarly characterized.

Paroxysms of dyspnœa belong to the least frequent forms of uræmic disturbance, if indeed such attacks have at any time a genuine claim to the designation uræmic. Fournier cites some cases of this kind; and one somewhat doubtful example has come under the observation of the writer.

Theories of Uræmia.—As morbid anatomy throws no light on the determining cause of uræmia, observers have been led to assume that that cause consists in the retention in the blood of some excrementitious material (or its derivatives), which is normally removed out of the body by the kidneys; but which being retained renders the blood incapable of ministering to the normal operations of the nervo-muscular system. Hence the various abnormities of motion and sense which have just been described. Hammond and Richardson, following the original notion of Willis, contend that the special poison in these cases is urea. Frerichs, on the

other hand, maintains that urea is itself innocuous; that uræmic symptoms depend upon the transformation of the urea in the blood into carbonate of ammonia. He supports this view by showing that carbonate of ammonia invariably exists in the blood of uræmic patients, and that if injected into the veins it produces fits of convulsions with intervening periods of coma exactly resembling genuine uræmic attacks. Treitz likewise believes that carbonate of ammonia is the poisonous agent, but that urea is first vicariously excreted into the alimentary canal, where it is speedily converted into carbonate of ammonia and then absorbed into the blood. This theory furnishes at least a rational explanation of uræmic vomiting and diarrhœa, and of the presence of the volatile alkali in the excreta. That urea is excreted by the intestines in Bright's disease is undoubted, and its rapid conversion into carbonate of ammonia has been proved experimentally by Bernard. Richardson and Hammond however have, since the promulgation of Frerichs' theory, found that ammonia naturally exists in the blood of healthy animals; and all subsequent observers, Pëtroff of Dorpat alone excepted, have failed to discover a larger amount of ammonia in the blood of animals rendered uræmic by the removal of their kidneys, than exists in the healthy state. It has also been shown that urine, urea, and chloride of sodium, as well as carbonate of ammonia, are capable of producing uræmic symptoms when injected into the blood.

The urea and ammonia theories of uræmia seem to be set aside by the recent experiments of Oppler, Schottin, Perls, and Zalesky, which indicate that uræmic phenomena depend mainly and essentially on the accumulation in the blood and tissues of those primary products of tissue-metamorphosis, creatine, creatinine, and other extractives, which in a later stage of histolysis are converted into urea and uric acid. These experiments tend to show that it is not improbable that urea and uric acid are actually formed *by the kidneys*, and that any traces of them found in the blood are due to reabsorption from the urinary channels.

Inquirers into the theory of uræmia may be reminded of the remarkable absence, in cases of obstructive suppression of urine, of coma and convulsions, the most common clinical features of uræmic intoxication.[1]

Dr. Owen Rees believes that the tenuity of the blood in Bright's disease is not without influence in the production of the cerebral symptoms. Traube has still further developed this idea. He contends that the watery state of the blood predisposes to interstitial transudations, and that when from any cause the tenuity of the blood-serum is still further increased, serous transudation takes place through the cerebral capillaries, giving rise to œdema of the brain. This œdema compresses the minute cerebral vessels, producing cerebral anæmia and thereby uræmic coma and convulsions; when the hemispheres are affected, he believes coma is produced; and when the central ganglia are involved, convulsive phenomena are the result.

After a careful review of the observations and experiments adduced on all hands, I have to express my conviction that none of the exclusive theories of uræmia have made good their claim to acceptance. The subjects of Bright's disease suffer under a vitiated condition of the blood and tissues: the blood is unnaturally watery and deficient in albumen; the blood and tissues are impregnated with the primary histolytic products, such as creatine, extractives, &c., and with excrementitious urinary compounds (urea and uric acid), perhaps also with some of their products of decomposition. This state appears to induce in the nervous centres a proneness to sudden disorder and loss of equilibrium, which may be developed at any moment by an exaltation of one or several of the disturbing elements, or by the supervention of some new and different source of irritation. This state of erethism is analogous to that which naturally prevails in children: in whom an irritation which would be of no moment in an adult suffices to awaken convulsive and comatose phenomena closely resembling those of uræmia.

Diagnosis of Chronic Bright's Disease.— Under ordinary circumstances, the symptoms and the condition of urine are so characteristic, that the disease can scarcely be confounded with any other: a persistently albuminous state of the urine, apart from heart disease, even in the absence of dropsy, hardly belongs to any other condition.

Cases of temporary albuminuria in febrile complaints, without structural changes of any importance in the kidneys, differ from Bright's disease in the absence of dropsical effusion; the quantity of albumen is also generally very small, and totally disappears on defervescence; the urea-excretion is natural, or even excessive, instead of being diminished.

The real diagnostic difficulties lie:— (*a*) in distinguishing acute and curable cases from chronic confirmed ones; (*b*) in determining the precise anatomical changes going on in the kidneys; and (*c*)

[1] See Urinary and Renal Diseases, 3d edit. p. 29.

in detecting the disease when masked by an inflammatory complication or a uræmic paroxysm.

(*a*) The case must be considered as belonging to the chronic and confirmed class if the disease has crept on insidiously, or if it is complicated with chronic phthisis, caries, long-continued suppurations, constitutional syphilis, enlarged liver or spleen, or hypertrophy of the left ventricle.

If the invasion has been acute, and albuminuria still lingers after the febrile symptoms have abated, time is required to establish the diagnosis. The fear that the disease has become confirmed grows stronger every day that passes without diminution of albumen in the urine. The characters of the urinary deposit supply important information at such a juncture. If the epithelial elements and blood-corpuscles are freely discharged, and the renal derivatives show little or no sign of fatty change, the probability is that we have to deal with the declining stages of an acute disorder. If, on the other hand, albumen persists in considerable quantity after the acute symptoms have passed away, and after blood has almost or quite ceased to appear in the urine, the disease has probably lapsed into a chronic and confirmed state; if, besides these untoward signs, the deposit shows marked fatty change, that probability becomes a certainty.

It must not be forgotten that occasional febrile exacerbations occur in chronic Bright's disease, in which the urine become scanty, high-colored, and perhaps bloody. These are liable to be confounded with the acute disorder, and when there are no clear indications of chronicity in the previous history, in the character of the renal derivatives, or in the coexistence of complications, the differential diagnosis may be quite impracticable until the lapse of time shall have cleared up the ambiguity.

(*b*) For the differential diagnosis of the types of degeneration going on in the kidneys the reader is referred to the synopsis of distinctive symptoms appended to the description of each anatomical type.

(*c*) When the case comes under observation masked by an inflammatory complication, such as pneumonia, or endo- or pericarditis, a clue to the primary affection must be sought in the previous history of the case, and in the associated symptoms. The primary renal disease is apt to be overlooked, and the case regarded as one of simple inflammation of the organ affected, if dropsy is absent, and there is no history of any. In such cases the urine assumes a febrile character, urea becomes abundant, and its specific gravity rules high; if, under such circumstances, the quantity of albumen in the urine be but small, the absence of Bright's disease may be counted on. The converse deduction is not, however, invariably warranted; in pneumonia I have seen the urine for some days "highly" albuminous, as the sequel showed, without the existence of any renal degeneration. In pneumonia and in pleurisy, when the urine is albuminous, the simultaneous implication of both sides furnishes a strong presumption that the inflammation is not simple but secondary to renal disease. The existence of notable anæmia, or of cardiac hypertrophy, without valvular disease, also favors the supposition of Bright's disease. The differential diagnosis of uræmic coma and convulsions has been pointed out under uræmia.

The absence of casts, generally more apparent than real, in albuminous urine, gives no security against the existence of renal degeneration. When the casts are small and few in number they subside very imperfectly, and are apt to escape detection even with the most careful examination. In other cases the absence of casts is only temporary; and I have known it most absolute in some of those hopeless cases where the renal disease is the ultimate issue of an inveterate strumous or syphilitic cachexia.

Prognosis of Chronic Bright's Disease.—The prognosis in confirmed chronic Bright's disease is exceedingly gloomy. The textural changes in the kidneys are of a kind that do not admit of reparation. The Malpighian bodies become enveloped in an exudation of low plastic material, tending to progressive contraction, and the tubuli are either blocked up with fibrinous plugs, or shrivelled into useless fibres. The disease advances unequally in different parts of the gland, and the sounder portions carry on, in an increasingly imperfect manner, the depurative functions, until the blood becomes so loaded with histolytic and urinous elements as to be incompatible with life. Long before this extreme limit is reached, however, death is caused in a large number of cases by one or other of the numerous complications to which the subjects of renal degeneration are liable.

But although the final prognosis in chronic and confirmed cases is thus unfavorable, in certain cases the structural changes cease to advance, the dropsical effusions, if any existed, are absorbed, and the condition of the patient remains stationary for months, or perhaps for years; nay, even in the more unfavorable cases there is still hope that by judicious management amelioration of the more distressing symptoms may be brought about. Except in the ultimate stages of the disease, the dyspeptic symptoms, the irregu-

larities of the bowels, the dropsical accumulations, and the bronchial catarrh, may be combated with good probability of success. Cases protracted to five or six years are not uncommon, and a few instances are recorded in which the patient has survived for ten, fifteen, or even twenty years; in some rare cases the disease does not prove fatal at all. Possibly in these cases only one kidney is affected, its fellow remaining sound; this may be inferred, not only from the great difference in the amount of disease sometimes found in the two kidneys after death, but with greater certainty from such a case as that recorded by Dr. Moxon, in which one kidney was in an advanced stage of degeneration while its fellow was normal.[1] The tenure of life under these circumstances is exceedingly precarious; and an imprudent indulgence or exposure may bring life, in a few hours or days, to the verge of destruction.

The favorable and unfavorable signs in Bright's disease have relation to the state of the skin, the duration of the disease, the degree of deviation of the urine from its natural quantity and composition, and the existence of complications.

The signs which indicate that an unfavorable termination is not far distant are: obstinate dryness of the skin, steady decrease of the urine, which had been previously abundant, without proportionate increase in its density—evidence that the disease has existed some years, repeated recurrence of uræmic phenomena, excessive serous effusion, excessive cardiac hypertrophy, a persistently restless state. Speedy death is indicated by the breaking forth of pneumonia or pericarditis, by suppression of urine, or uncontrollable vomiting and diarrhœa. The absence of these signs may be construed in a favorable sense as indicating a stationary condition and the probability that the final issue may be yet far distant.

An excessive proportion of albumen in the urine, although a proof of the activity of the morbid process, and therefore a sign of evil import, is not necessarily prophetic of impending death. In a case observed by me, the urine, which was examined almost daily, became constantly solid on boiling, for a period of more than two months; during this time the patient's condition remained stationary; he was then seized with pneumonia, of which he speedily perished.

Treatment of Chronic Bright's Disease.—In the management of cases of confirmed Bright's disease, three objects are to be especially aimed at, namely: (*a*) to hinder the further extension of the structural changes in the kidneys; (*b*) to prevent the occurrence of uræmic and inflammatory accidents; and (*c*) to palliate or remove certain threatening or troublesome symptoms, such as anæmia, dropsy, and dyspepsia.

To fulfil the first indication, the conditions under which the complaint originated must be carefully traced out, and the patient removed as completely as possible from their further influence. In some instances this is practicable: as when the disease follows intemperance or long-continued exposure to wet and cold. In protracted suppurations, necrosis, caries, joint-disease, stricture of the urethra, and old vesical inflammation, the possibility of the development of renal degeneration should be kept in view by the surgeon, and should have weight in considering the propriety of operation. In all such affections the condition of the urine should be narrowly watched, the first appearance of albumen being a warning that the opportunity for operative procedures is passing away never to return.

There is no evidence that local counter-irritants of the severer class—issues, setons, and the like—applied over the kidneys, exert any good effect; and the ulcerations which they sometimes leave are apt to prove intractable. Mustard-poultices, tincture of iodine, and dry-cupping, may be applied when the loins are the seat of aching pain, but their influence on the renal lesion is probably *nil*. Blisters are inadmissible on account of their specific irritating effects on the urinary system.

The patient should be completely clothed in flannel, and the activity of the skin should be promoted by moderate walking or carriage exercise, and the occasional use of warm baths and frictions of the surface. The bowels should be opened at least once daily, and the diet should be light and nutritious. Milk agrees well as a rule, and may be freely taken. Two or three glasses of claret or hock daily, or a glass of sound beer, are permissible; but the stronger wines and all spirits usually agree badly, and should not be allowed except when special circumstances imperatively call for their administration.

Saturation of the system with iron is the best safeguard against the profound anæmia accompanying chronic renal degeneration. I have been in the habit, when the secondary symptoms or complications do not call for special treatment, of giving fifteen or twenty-five drops of the muriated tincture of iron in a wine-glass of water night and morning; combined, in cases with strumous tendency, with cod-liver oil.

If the tincture produces headache, or disturbs digestion, the citrate of iron, with or without quinine, the syrup of the phosphate or of the iodide of iron, the saccha-

[1] Path. Soc. Trans. vol. xix. p. 268.

rated carbonate, or the ferrum redactum, may be given. Certain substances, such as the mineral acids, especially nitric acid, iodide of potassium, tannin and gallic acid, are said to be capable of diminishing the quantity of albumen lost by the urine. Dr. Parkes exhibited large doses of tannin and gallic acid without producing any diminution of albumen; and I have in a number of cases used gallic acid for many weeks without any favorable influence on the excretion of albumen; in some instances it occasioned serious gastric disturbance. Oppolzer has recommended alum—the trials of which by Heller seem to have been satisfactory.

When a stationary condition is maintained the treatment should be limited to the enforcement of sound hygienic rules and preventive measures. The patient should be made clearly to understand that he is to treat himself as a valetudinarian; and that in his clothing, his eating, drinking, exercise, and general mode of life, he must go by rule if he would avoid running the most fatal risks.

The *dropsical effusions* are most effectually combated by hydragogue cathartics and warm baths. For general use there is no hydragogue superior to the compound jalap powder; it acts quickly, and produces two or three copious watery stools. The nausea and sickness, which it too often occasions, may be mitigated by giving an active dose (for an adult ʒiij of the bitartrate and fifteen or twenty grains of jalap corrected with a little ginger) early in the morning twice or thrice a week. The operation of the medicine passes over in a few hours, and the patient has leisure to recruit himself in the intervals between the doses. Christison speaks in high terms of gamboge, which he employed in doses of five to seven or, very rarely, nine grains finely pulverized, with half a drachm of the bitartrate to prevent griping, every second day, or in urgent circumstances every day. Colocynth, scammony, and elaterium have also been employed; no remedy is superior to the last when the serous accumulation is very threatening and immediate effects are demanded. It may be given in doses of one-sixth or one-fourth of a grain every three or four hours until free evacuations have been obtained. It must not be overlooked that exhausting diarrhœa sometimes occurs spontaneously in the later periods of the disease, and that the use of drastics has been known to originate this untoward symptom; their use should, therefore, be immediately desisted from, if the diarrhœa show signs of proving intractable.

Warm baths are unquestionably the most effective of diaphoretics—they not only promote cutaneous transpiration, but often increase the secretion of urine at the same time. They may be applied in all their various modifications—warm water, hot air, steam, or the blanket-bath. Liebermeister describes as highly effective a method of applying the warm-water bath, by which the temperature, which is 98° when the patient first enters the bath, is gradually raised by the admission of warm water to 108°; after remaining in the bath about thirty-five minutes, the patient is packed in hot blankets. Headache, suffusion of the face, and unwonted heat of skin occasionally follow the use of warm baths, and may even necessitate their abandonment; generally, however, after a few trials patients can take their baths with pleasure as well as with advantage. The effect of pharmaceutical diaphoretics is very uncertain; the chief are Dover's powder, James's powder, and liq. ammon. acetatis.

Diuretics of the most opposite classes have been recommended by different writers; my own experience has not given me a high opinion of their efficacy. In judging of their effects, some observers have not sufficiently considered that a spontaneous diuresis is the normal issue of acute renal dropsy tending to recovery; and that in patients with contracting kidneys profuse diuresis is an ordinary feature of the quiescent state in the middle periods of the disorder: hence the conflicting testimony as to their utility. Bright, who had but slight confidence in them, was in the habit of prescribing uva ursi and pyrola umbellata; Christison relied on digitalis combined with cream of tartar. Rayer perceived little advantage from digitalis or squills, and found that at length they almost always deranged the stomach; according to his experience, horseradish tea of all diuretics offered the best chance of success. Tincture of cantharides was employed by Dr. Wells in seven cases in doses of thirty to sixty drops a day, with good effect in five. Rayer also reports well of it in some cases, but thinks it "an uncertain remedy, which might be dangerous in inexperienced hands." I have tried in my own practice dandelion, broom-tops, and belladonna with unsatisfactory results.

When other means of evacuating the dropsical effusions fail, and erythema and gangrene of the skin of the lower limbs or genitals are imminent from the tension of the integuments, acupuncture or incision of the legs may be resorted to. The great disadvantage of this method is the liability that it may be followed by erysipelas unless stringent precautions are taken. I have tried both incisions and punctures and prefer incisions to punctures. One or two cuts with a lancet should be made lengthwise in the calf of the leg, or over

the external malleoli, or one may be on the dorsum of the foot; they should be three-quarters of an inch long, and penetrate fairly into the subcutaneous tissue. The limb should then be wrapped in hot, moist flannels which should be changed at first every two hours; at each change the legs and especially the incised parts should be thoroughly sponged with warm water, and the flannels which are soaked with the discharge should be completely cleansed before being re-applied. Traube recommends that the incisions be frequently washed with chlorine water. If these precautions be adopted erysipelas will rarely follow. This treatment is followed by great relief at the time, and sometimes with prolonged advantage.

In cases characterized by a copious flow of urine (contracting kidney) dropsical effusions, if present, are usually slight and partial; and their existence depends chiefly on the watery state of the blood and the lowered tonicity of the tissues. In these cases ferruginous preparations, tonics, and mineral acids, by improving the general health, are more effectual against œdema than diuretics and cathartics. It is in cases of this class also that change of air or even a sea-voyage may be recommended, provided always that the disease be not too far advanced. [Da Costa[1] has recorded a case of recovery from acute Bright's Disease under drachm doses of jaborandi given thrice daily. Copious diaphoresis and diuresis were produced by this remedy.—H.]

Bronchial catarrh and secondary inflammations should be treated with the primary mischief kept in view. Mercury and bloodletting are inadmissible—the former (unless in the most guarded way) on account of the peculiar susceptibility of the system in Bright's disease to mercurial preparations, the latter on account of the sapping of the strength which has already taken place. Internal antiphlogistics—aconite, digitalis, antimony—may be freely used together with the external application of chloroform epithems, hot poultices, and dry-cupping.

Dyspeptic symptoms are readily controlled in the early stages by a careful revision of the diet and the use of vegetable bitters, prussic acid, and antacids. When obstinate vomiting of uræmic origin sets in, creosote, morphia, and ice permitted to melt in the mouth are the most effective remedies. Diarrhœa of similar origin must be combated by acetate of lead, opium, and sulphuric acid.

Uræmic symptoms.—When these appear, renewed efforts should be made to increase the flow of urine, and to awaken the vicarious activity of the skin and intestines by the measures already described. If coma and convulsions have actually seized the patient, further energetic action is demanded. Frerichs, consistently with his view that carbonate of ammonia is the poison in these cases, recommends a treatment designed to neutralize the free ammonia and reduce it to a state of innocuous combination. He directs chlorine (in the form of inhalation or as solution) and the vegetable acids to be taken internally, the body to be sponged with vinegar, and vinegar to be used in injections. Chloroform inhalation is the most prompt and ready means of controlling the convulsive paroxysms; but when the uræmic seizure begins with drowsiness and gradually passes on into insensibility, or when convulsions occur only as breaks in a continuously comatose condition, chloroform affords no prospect of relief.

Bloodletting is a powerful means of staving off the immediate danger in uræmic coma, and convulsions; but it is only advisable in sthenic and recent cases. In the uræmic coma of acute Bright's disease, and in certain cases of puerperal eclampsia, the blood is as yet not materially impoverished, and the type of renal mischief is one that gives full hope of eventual recovery, while the attack itself is of extreme danger. In these, free and even repeated venesection is decidedly and urgently demanded. But it is otherwise when the renal mischief is chronic and incurable. The attacks themselves are not so imminently dangerous as when occurring in the acute form of the disease; patients frequently survive repeated uræmic paroxysms without the aid of venesection; the blood is commonly thin and poor; and lastly, there is not any prospect of ultimate recovery. Under these circumstances loss of blood is more likely to shorten than to lengthen life. Further, as Christison remarks, speaking of advanced renal mischief, when the torpor becomes considerable the removal of blood seems of little or no use. In some of the cases reported by Bright, death occurred from coma on the very day of free and repeated venesection. I can only conceive of two contingencies in which withdrawal of blood in quantity is justifiable in chronic renal disease; one is when coma comes on rapidly in a person whose constitution is not, as yet, seriously deteriorated, and whose prospects of life, apart from the uræmia, may extend to many months or some years; the other is, when there is a necessity for temporary restoration of the faculties paramount to the general chance of prolonging life.

[1] Hospital Gazette, 1879; quoted in Phila. Med. Times, Oct. 25, 1879.]

NEPHRITIS AND PYELITIS CONSECUTIVE TO AFFECTIONS OF THE LOWER URINARY TRACT.

By Marcus Beck, M.S.

The secondary affections of the kidney arising from diseases of the lower urinary tract have perhaps received less attention from physicians than their great importance and frequency would deserve. It is for this reason partly that their exact diagnosis and pathology are still but imperfectly understood. Their frequency may be estimated from the fact that of sixty-six deaths from diseases of the urinary organs occurring in the surgical wards of University College Hospital, in a period of six years, forty were directly due to secondary inflammation of the kidneys. In the practice of the physician it is less common to meet with cases in which secondary renal inflammation forms an important element of the disease. It is, however, a frequent termination of the cystitis occurring as a consequence of retention and decomposition of urine in those diseases of the spinal cord and brain which give rise to paralysis of the bladder, and in cases of calculous pyelitis the changes in the substance of the kidney are identical with those resulting from many diseases of the bladder.

The morbid conditions of the kidney arising as the consequence of vesical or urethral disease, may be divided into four chief groups.

1st. The effects of pressure caused by the obstruction in the urinary passages.

2d. Diffuse interstitial inflammation, acute or subacute.

3d. Interstitial inflammation with scattered points of suppuration.

4th. The cicatricial kidney, occurring after recovery from diffuse or localized interstitial inflammation.

Although typical specimens of these four varieties are readily recognizable and distinguishable from each other, it is most common to find them variously intermixed. Thus a kidney showing in a high degree the effects of pressure may present, in addition, either acute diffuse inflammation or scattered points of suppuration, and in the same way a small puckered cicatricial kidney may suffer from a fresh acute attack from a recurrence of the primary disease in the lower urinary tract.

In the great majority of cases the final stages of the disease are accompanied by acute pyelitis, and it was on this account that Rayer gave the name of pyelo-nephritis to this affection. Pyelitis is not, however, a constant accompaniment even of the acute suppurative form.

1. The Effects of Pressure.

Causes of Obstruction to the Flow of Urine.—In any obstruction of the urinary passages, the secretion of urine still continuing to take place, the parts above the obstruction become distended and tensely stretched. If the obstruction be complete, as soon as the pressure in the urinary passages becomes equal to the blood-pressure in the vessels of the kidney, secretion will be to a great extent arrested. Such a condition therefore does not lead to rupture of the ureters or bladder unless their coats are weakened by previous disease. The obstruction to the free flow of urine may exist at any part of the urinary tract from the pelvis of the kidney to the orifice of the urethra, and in some rare cases it is said that a tight phimosis has given rise to serious secondary renal disease. The effect upon the kidney is not however induced in exactly the same way in all cases. In the ureter the most common cause of complete obstruction is the impaction of a calculus or some congenital malformation. Incomplete obstruction is caused occasionally by tubercular deposit in the submucous tissue, and by pressure from tumors. The most common seat of obstruction is, however, at the entrance of the ureter into the bladder, as by the growth of a villous tumor round about the orifice. In the above cases the cause and nature of the obstruction are evident. It is not quite so clear, however, how it is that the same signs of obstruction to the flow of urine from the kidney are found in most cases of neglected stone in the bladder or stricture of the urethra. It has been supposed that the natural valved arrangement of the entrance of the ureter into the bladder becomes deranged, so that at each act of micturition some urine is forcibly driven backwards into the kidney. This theory is, however, untenable; in the first place because intermittent pressure, occurring at such long intervals, would not cause the amount of dilatation

of the kidney often found in these cases; and, secondly, because numerous observations have clearly shown that the valvular action of the orifices of the ureters is scarcely ever, if ever, impaired. We must therefore look for some obstruction to the flow of urine at the orifices of the ureters themselves, and there is no difficulty in finding enough to account for the effects produced. In all cases of stone, or stricture of the urethra, in which great signs of pressure are found in the kidneys, two conditions are almost constantly present, hypertrophy of the bladder, and chronic inflammation, with thickening of the mucous membrane. In a hypertrophied bladder the thick bundles of muscular tissue will press more or less into the ureter and tend to narrow its calibre; the swelling of the orifice and the thickening and induration of the mucous membrane and submucous tissue still further tend to narrow the passage for the urine; and thus a more or less tight stricture of the orifice is produced, obstructing the free flow into the bladder, and necessitating a constant increase of pressure in the kidney itself in order to drive the urine onwards. In enlargement of the prostate, the bladder can never be completely emptied. It is always kept at a certain degree of tension, and of course the same pressure must exist in the parts above, even to the very ends of the urinary tubules. Similar signs of pressure in the kidney are also found occasionally as the result of simple chronic cystitis. Under these circumstances it is due, as in stone, to hypertrophy of the bladder and thickening of the mucous membrane at the orifice of the ureter. If any further proof were needed that it is at the orifices of the ureters, and not at the neck of the bladder, or in the urethra, that we are to look for the immediate cause of the obstructed flow from the kidney in cases of stone, stricture, or cystitis, it is furnished by the fact that the signs of pressure are often very different on the two sides, showing that we must look for something more than the single obstruction in front to account for the changes in the kidney.

The effects of long-continued increase of Urinary Pressure as the result of Obstruction to the Passage of Urine.—The observation of the uncomplicated effects of increase of the urinary pressure in the kidney is possible in only a small proportion of cases. In the great majority the fatal result is brought about by an acute attack of inflammation, usually accompanied by the extension of decomposition of the urine from the bladder to the pelvis of the kidney, and consequent acute pyelitis and suppurative nephritis; and thus the chronic disease which preceded the acute attack is completely concealed. It is only in cases of pressure upon the ureter from without, and in a few of disease of the bladder or urethra, in which death occurs from some independent cause, that the effect of increased pressure can be studied with advantage.

The earliest effect observable is a slight dilatation of the ureter and pelvis of the kidney. The walls of the ureter are thickened, chiefly from hypertrophy of the muscular coat. The mucous membrane is usually of a more opaque white color than natural. The calices of the pelvis are somewhat dilated. The kidney itself is slightly increased in size. The capsule strips off without any particular difficulty, but may tear the kidney substance in so doing. The venous stars on the surface are usually well marked, and the larger veins of the kidney are often full of blood. A section of the kidney shows the cortex pale, slightly increased in width, and tough in consistence. The Malpighian bodies may be seen as red dots in some cases. The pyramids show little change; they are usually pale like the cortex. Microscopic examination shows that the whole of the changes are due to an overgrowth of the interstitial connective tissue of the kidney. This is usually most marked about the Malpighian bodies, which may be surrounded by a complete zone of small round cells, sometimes more than one layer in thickness. The change is extremely irregular, varying in every field of the microscope; parts which are apparently perfectly healthy existing side by side with others in which the change is very marked. The epithelium shows little, if any, change. In the pyramids the straight tubules may be slightly dilated.

This form of kidney is somewhat difficult to recognize without the aid of the microscope, as from the anæmic appearance of the cortex and the increase in size, it may resemble the effects of catarrhal inflammation or cloudy swelling. The anæmic appearance of the kidney after death must not be taken as an indication that it was in the same condition during life. In all renal inflammations, accompanied by swelling or by increase of the fluid pressure in the urinary tubules, the distension of the organ is resisted to a certain extent by the capsule, and all the tissues of the organ are more or less squeezed together. The consequence of this is, that as soon as the action of the heart ceases, the vessels empty themselves, partly backwards into the renal artery, and partly onwards into the veins. It is for this reason that the larger veins are sometimes full of blood.

The next stage of the effects of pressure is characterized by a gradual absorption of the pyramidal portion of the kidney. This commences from the papillæ, which at first become rounded and flattened.

Ultimately the whole pyramidal portion of the kidney may entirely disappear, the situation of each pyramid being marked by a deep hollow, formed by the expanded calyx. This process of destruction of the pyramids is one of absorption, not of ulceration. The hollow left is lined with a perfectly smooth, white membrane, continuous with the mucous membrane of the pelvis. The cortex may for some time after the destruction of the pyramids remain thicker than natural from the great overgrowth of the interstitial connective tissue. Finally it also becomes stretched and thinned, till the whole kidney may resemble a large, thick-walled cyst; the wall on one side being composed of the thickened and expanded pelvis, and on the other of the stretched and thinned cortex. This form is usually spoken of as the sacculated kidney. In these cases the capsule is thickened and firmly adherent. It may be more adherent than natural to the surrounding fat. The cortical substance is exceedingly tough, so much so that it cannot be broken down by the pressure of the finger and thumb. Its color is opaque and whitish. The ureter may be dilated to such an extent as to resemble a piece of the small intestine. The microscope shows that the change is accompanied by great overgrowth of the intertubular connective tissue—a condition of chronic interstitial inflammation. The new growth is very abundant round the Malpighian bodies, and may accumulate to such an extent as to strangulate the vessels and cause their obliteration. The corpuscle is then composed of a central transparent substance, almost homogeneous in appearance, but marked by a few concentric curved lines representing the obliterated tufts of vessels, surrounded by a concentrically-laminated layer formed from the thickened capsule. In other bodies the capsule may be greatly thickened without the vessels being obliterated. This thickening of the Malpighian capsule occurs very early in the affection, and when found in kidneys in which an acute attack of interstitial inflammation has immediately preceded death, it forms a valuable indication of the antecedent chronic affection. The tubules are usually irregularly dilated in parts, but the dilatation is not so great as might be expected, being limited by the new growth between the tubules. If any of the pyramidal portion remain, microscopic examination shows merely dilatation of the straight tubules, with abundant small-cell infiltration of the intertubular structure. The epithelium throughout the kidney is healthy.

Complete obliteration of the ureter does not arise as a secondary result of diseases of the bladder or urethra. When it does occur it is usually due to congenital malformation, pressure of tumors, impaction of a calculus, or tubercular pyelitis, and it will be treated of with these diseases.

The effects of increase of pressure in the urinary tubules may therefore be said to be the induction of a chronic interstitial nephritis, accompanied by the gradual absorption of the structures of the kidney, commencing with the pyramids and gradually extending to the cortical substance. That abnormal pressure in the urinary tubules should thus induce a chronic interstitial change is easily explained. Undue distension of the urinary tubules cannot exist without a greater or less degree of obstruction to the circulation through the vessels of the kidney, acting most forcibly on the veins, as in them the blood-pressure is lowest. The venous flow thus being more or less impeded, a condition of passive congestion will be induced, and it is well known that from whatever cause this arises, its most marked effect on the kidney is an overgrowth of the connective tissue. This alone, however, would not account for all the changes resulting from obstruction in the urinary passages, as it is not merely an overgrowth of the connective tissue that is found, but an accumulation of small round cells far exceeding in amount that arising merely as the result of passive congestion, and this we must look upon as a chronic inflammatory change set up by the direct irritation of the tension to which the kidney substance is exposed.

The overgrowth of the connective tissue of the kidney which results from an increased pressure in the tubules may be looked upon partly as a beneficial change, rendering the kidney more capable of withstanding the stretching to which it is exposed; and it is for this reason that, even in very advanced cases, the dilatation of the tubules is seldom very great. Moreover, as the secretion of urine is in a great measure dependent upon the difference between the pressure of the blood in the Malpighian tufts and that of the urine in the tubules, it would be diminished to a dangerous degree, were not that in the Malpighian tufts somewhat increased by the slight obstruction to the venous circulation caused by the new growth between the tubules. It is as a result of this that, so far from the secretion being diminished, it is usually increased, often greatly, and at the same time its specific gravity is correspondingly lowered. On the other hand, a kidney, the venous circulation of which is more or less obstructed, if exposed to an attack of acute congestion such as may arise from exposure to cold, or follow the introduction of a catheter, suffers much more severely than a healthy organ. Its vessels may become choked with blood to

such an extent as to lead to complete stasis, accompanied necessarily by cessation of the secretion of urine, which unless shortly relieved must terminate fatally. This seems to be the explanation of many of those cases of death from suppression of urine which follow an operation on the bladder or urethra. In other cases the acute hyperæmia may not be sufficient to cause complete stasis, but as the kidney is already suffering from a chronic inflammatory change, it may exaggerate the activity of the process, and convert the chronic interstitial nephritis into an acute form, causing such injury to the organ as speedily to prove fatal.

Supposing the obstruction to the escape of urine to be completely relieved, as by the regular introduction of a catheter in enlarged prostate, or by the cure of a stricture, the chronic cystitis will subside, and the bladder, if it have been hypertrophied, will gradually assume its normal proportions, and thus all impediment to the free flow of urine through the orifices of the ureters will be removed. The cause of irritation to the kidney being thus removed, a process of cicatricial contraction of the new growth between the tubules sets in, and the form afterwards to be described as the cicatricial kidney is produced.

In no case that I have observed has the chronic interstitial nephritis arising from increased urinary pressure, even when it was due to great contraction of the organ, been accompanied by the hypertrophy of the heart so commonly seen with the granular contracted kidney; and as the histological morbid conditions are almost identical, this fact would support the view of Sir W. Gull and Dr. Sutton, that the hypertrophy of the heart is due to a general change in the small arteries and capillaries, and not to the condition of the kidney. The small arteries frequently show great hypertrophy of their muscular coats, such as is seen in the granular contracted kidney, but this would seem to be due merely to the increased tension to which they are exposed in consequence of the obstruction to the venous flow. Such increase of tension must call for greater force in the muscular coat of the artery, in order that it may perform its function of regulating the blood-supply, and hence the hypertrophy; for it is an invariable law that when involuntary muscular fibre is called upon for increased work, hypertrophy speedily results.

2. Diffuse Interstitial Nephritis.

In this form of secondary renal inflammation both kidneys are invariably affected. The whole kidney is swollen; the surrounding fat is occasionally somewhat adherent to the capsule, but usually separable without great difficulty. The capsule is less transparent than natural, and may be abnormally vascular; small vessels, visible to the naked eye, ramifying in its structure. It separates with ease, but in so doing often slightly tears the kidney substance, and leaves the surface coarse and irregular. On removing the capsule, the kidney is seen to be of a pale yellowish-white color, or it may be mottled here and there with red patches. If it present a mottled appearance, the red and white patches will be found often to be arranged so as to correspond with the bases of the various lobules of the gland, in some of which the disease is more advanced than in others, the pale parts being those in which the change is most extensive. The stellate veins usually to be seen on the surface of the kidney are in most cases very clearly marked and gorged with blood. On laying the kidney open the cut surfaces become slightly convex, showing that the elements of the kidney have been compressed within the capsule by the exudation between the tubules. The cortex is of a pale yellowish-white color, or mottled with red, like the surface. The consistence varies; if the attack is of quite recent origin, and has not been preceded by any chronic change due to increase of pressure in the urinary tubules, it is very soft, breaking down readily under the pressure of the finger and thumb; on the other hand, if there has been a previous overgrowth of the interstitial or connective tissue, it may be tougher than natural. The Malpighian bodies are not usually clearly visible, but they may appear as red dots. The pyramids are sometimes pale, but not unfrequently intensely red, contrasting strongly with the pale cortex. Yellowish streaks may be seen in some cases running parallel to the straight tubules, but their appearance is by no means constant. The anæmic condition of the cortex, as it is seen after death, must not be taken as evidence that during life it was in the same condition. It is most probable that the vessels empty themselves as soon as the heart ceases to beat, the kidney being, as before stated, somewhat compressed within its capsule. Confirmatory of this is the fact that the large veins at the cortico-medullary junction and the interfascicular veins are usually fully distended with blood. The pelvis may in some cases be perfectly healthy; in others, its mucous membrane is congested, branching vessels ramifying in all directions in its structure; but most frequently it is inflamed, intensely reddened, and sometimes covered with a membranous exudation. The contents of the pelvis are sometimes acid and free from odor; and it is in these cases that there is little or no pyelitis. In others the urine is ex-

cessively foul, and has evidently been in a state of decomposition before death; and, under these circumstances, the intense inflammation of the pelvis is always present.

It is not always easy to recognize the exact condition of the kidney by the naked eye, as the appearances may closely resemble those of the large white, or the fatty kidney. The microscope alone can in all cases exactly determine the pathological changes. On examination of a thin section of the cortex, it will be found that the chief change noticeable is an abundant accumulation of small round cells between the tubules, and especially round about the Malpighian corpuscles. The condition exactly resembles that before described as resulting from simple increase of pressure in the urinary tubules, but greatly intensified. The accumulation of small round cells is not by any means uniform. In the same field of the microscope may be parts in which the kidney structure may appear almost normal, and others in which the tubules may be pressed upon by the new growth to such an extent as completely to close them. In parts in which the new cells are crowded together to this extent, it is often difficult to recognize the tubule. No trace of a membrana propria is to be seen, and the site of the tubule is marked merely by a group of epithelium cells packed closely together amongst the surrounding small round cells; the Malpighian bodies, besides being completely encircled by multitudes of new cells lying outside their capsules, usually present large numbers of nuclei crowded amongst their loops of vessels, so that they may be scarcely recognizable. The epithelium generally presents no very marked changes, beyond being somewhat more granular than natural, and a little swollen. The nuclei of the cells are clearly visible in specimens prepared with the ordinary staining fluids, and no reagents are necessary to bring them into view. Oil globules are never present. It is not uncommon to find some of the tubules plugged with fibrinous casts. In very acute cases small round cells, exactly resembling those outside the tubules, are found within them, surrounded by epithelium, which shows no marked signs of change beyond slight cloudiness and swelling. It is difficult to suppose that these are derived from the epithelium; and it is far more probable that they have found their way in from without. If these cells are washed on by the flow of urine from above they would appear as pus cells in the urine. The epithelium washes out of the tubules very readily, possibly on account of its adhesion to the membrana propria being lessened; but this must not be taken to indicate a condition of desquamative catarrh; nor must it be assumed that the tubules seen to be empty in the preparation, were empty during life. More gentle handling of the sections whilst mounting them would probably have enabled the observer to obtain specimens in which all the tubules were lined with epithelium. The bloodvessels are usually empty, but in some cases they may be found engorged with blood, and even in parts ruptured, giving rise to small extravasations in the inter-tubular tissue, and occasionally even into the tubules themselves.

3. Acute Interstitial Nephritis, with Scattered Points of Suppuration.

(*Suppuration of the Kidney, suppurative nephritis; and, when accompanied by pyelitis, pyelo-nephritis.*)

This form of kidney is found in the great majority of fatal affections of the lower urinary tract, and it has been wrongly assumed by some writers to be the only form of fatal renal affection occurring in such cases. It has also been stated that it is invariaby associated with acute pyelitis and the presence of decomposing urine in the pelvis of the kidney. This also is incorrect. I have seen several cases of disseminated suppuration of the kidney, in which the pelvis was free from acute inflammation, and the urine it contained acid and without any odor of decomposition. In one case both kidneys were equally dotted with minute points of suppuration, but in the pelvis of one only was the urine decomposing.

The naked-eye appearances of acute suppurative nephritis consist essentially of those described as occurring in simple acute nephritis, with the addition of minute scattered abscesses, varying in size from a pin's head to a pea, almost invariably confined to the cortical substance. The fat surrounding the kidney is usually œdematous, and more or less adherent to the capsule. The whole kidney is enlarged, swollen, and softened. The capsule separates readily, often tearing the kidney substance in so doing. The act of stripping off the capsule often opens up many of the small collections of pus. Occasionally they are found to have burst beneath the capsule, which may be for a considerable area separated from the kidney substance by pus. If this be not the case, each collection of pus shows as a yellow spot on the surface of the kidney, surrounded in most cases by a zone of intense red, due to congestion. In an earlier stage yellow spots, surrounded by a red zone, are often seen, which, on being cut into, are found not to contain pus, but to be excessively soft, and on the point of

breaking down into fluid. Between the points of suppuration the surface of the kidney is irregular and coarse, and of a pale yellowish-white color, often mottled with red, as in simple acute interstitial nephritis. The small abscesses are usually grouped together in areas corresponding to the bases of the lobes of the kidney; that is to say, the areas corresponding to separate pyramids of Malpighi. Some of these areas are completely free, whilst others contain many minute points of suppuration. The exact situation of the individual abscesses is more difficult to determine from an observation of the surface. Rindfleisch states that they correspond to the points at which the interfascicular veins appear upon the surface. It must not be concluded, however, that because they appear in this situation the vein has anything directly to do with their production, for it is at this point that the connective tissue is most abundant, and the lymphatics of the kidney follow the same course as the veins. On bisecting the kidney, the cortex presents a mottled appearance, similar to the surface; but the chief point to be observed is the relation of the small purulent collections. These will be found to be almost always continued downwards in the form of pale yellow streaks, extending into the cortical substance, along the course of the interfascicular veins, and continued in many cases into the pyramids. These pale streaks follow, therefore, the course of the connective tissue and lymphatics, which are most abundant in the neighborhood of the interfascicular veins. The abscesses, and the pale streaks between them, naturally assume a wedge-like form, in consequence of the anatomical arrangement of the structures amongst which they are situated; but this is very different from the form of an embolic abscess. In embolic patches the width of the base of the wedge is seldom less than half its length, but in these abscesses of interstitial nephritis the base showing on the surface may be only the width of a pin's head, while the length of the wedge may be one inch or more. Embolic patches, moreover, scarcely ever extend into the pyramids.

The medullary portion of the kidney is often intensely congested, but more commonly it is mottled with yellowish-white streaks, running parallel to the tubules. Dickinson describes "sharply defined white lines which start from the tops of the mammillary processes in the pelvic cavity, and pass into or through the cones in the direction of their striation." These he states to be dilated tubes (Med.-Chir. Trans., 1873). Such lines are no doubt occasionally visible, but by no means constantly so.

The pelvis of the kidney is in the great majority of cases acutely inflamed. Its mucous membrane presents usually patches of dark gray pigmentation, the result of previous attacks of pyelitis, but the greater part is of an intense purple. Here and there may be seen patches of ulceration, and the surface may be covered by a dense false membrane, like that of diphtheria, which is usually gritty, from the deposit of amorphous phosphates in and upon it. The mucous membrane is everywhere swollen and softened. The whole ureter is usually in a condition similar to that of the pelvis. In the cavity of the pelvis is usually an abominably fetid mixture of putrid urine, mucus, and pus, often tinged with blood. Acute pyelitis is, however, not a constant accompaniment of suppurative nephritis. Cases do occasionally occur in which the ureter and pelvis are quite free from acute inflammation.

A microscopic examination of a kidney in a state of acute suppurative inflammation shows clearly that the change does not commence within the tubules. It is primarily extra-tubular, and the alterations in the epithelium, which are the same as those before described, are evidently secondary to the interstitial change. All the morbid changes previously described, as occurring in acute interstitial nephritis without abscesses, are to be seen in this form of the disease also, but at certain points the inflammatory process has reached the stage of suppuration. In a pyæmic kidney the disease is localized around the spots at which the septic embola have lodged, and the rest of the kidney is healthy, with the exception of the swelling of the epithelium, invariably found as the result of pyæmia or septicæmia. In acute suppurative nephritis, the change is much more general, no large area of the kidney being found free from marked interstitial change; but, as in the non-suppurative form, the degree of affection varies greatly in almost every field of the microscope. If a section be cut so as to include the edge of one of the small points of suppuration, the following conditions are seen, proceeding from without inwards, towards the centre of the abscess. Most distant from the centre the only sign of disease will be an accumulation of small round cells between the tubules. The epithelium is usually slightly swollen and cloudy, but the lumen of the tubule is quite free, and the nuclei of the cells are readily seen without the use of reagents. The outline of the tubule is distinctly visible. In the next stage nothing resembling a membrana propria is to be seen. The epithelium cells are pushed together and are closely surrounded on all sides by the small round cells. Frequently the tubule is seen to be filled with small round cells similar to those outside

it: the epithelium still being distinctly recognizable. Nothing is seen in the epithelium cells to suggest that these small round cells have been derived from them. Finally all trace of tubule and epithelium disappears, and the space becomes occupied merely by a mass of small round cells, which after the softening of the intercellular substance becomes pus. The vessels in the affected area vary much in appearance. In some cases they seem to be emptied of blood immediately after death, and they are then very difficult to recognize; in others they are greatly engorged. It is not unfrequent to find clots in some of the smaller veins, both in the pyramids and cortex, but this would seem most probably to be a secondary effect of the inflammation going on outside them. Of the lymphatics it is impossible to speak positively, as, in addition to the great difficulty at all times existing in examining these vessels in the kidney, they are completely obscured in acute interstitial nephritis, by the abundant small cell infiltration of the intertubular tissue. It must be remembered, however, that the chief seats of inflammation and suppuration are in most cases along the lines of the interfascicular veins, and in this situation the lymphatics are most abundant. In the pyramids the straight tubules are almost invariably denuded of epithelium.

In cases in which the acute inflammation has followed on a chronic process, the signs of the previous disease are usually completely concealed by the recent change. Occasionally, obliterated Malpighian tufts may be found, which are certain evidence of the antecedent chronic change.

In conclusion, it may once more be stated that the suppurating kidney, secondary to affections of the lower genito-urinary tract, is not merely an affection in which scattered points of suppuration occur in the substance of the gland, but it is an acute interstitial inflammation, affecting the whole kidney, and culminating at various points in suppuration.

In acute diffuse interstitial nephritis, whether suppurative or not, the condition is very frequently conjoined with signs of previous distension of the kidney by increased pressure within the urinary tubules. The pyramids may be more or less completely destroyed, the cortex even expanded and thinned, and the pelvis and ureters greatly dilated. There is no doubt that the acute forms, whether suppurative or not, are greatly predisposed to by the chronic interstitial change set up by the distension of the kidney.

As an occasional result of suppurative nephritis, an abscess may burst through the capsule, and give rise to a large collection of pus round about the kidney (peri-nephritic abscess). Similar collections of pus may form rapidly from ulceration and perforation of the pelvis, especially if the ureter become blocked from any cause. That the formation of a peri-nephritic abscess is so rare in suppurative nephritis is due to the fact that it is rare to find only one kidney affected, and when both are attacked death usually supervenes, long before the abscesses reach such a size as to burst through the capsule.

4. The Cicatricial Kidney.

It is not at all unfrequent in making post-mortem examinations of patients, who have at some time suffered from an affection of the urinary organs, to find one or both kidneys shrunken, toughened and irregular in form. This condition may so closely resemble the ordinary granular contracted kidney, as to be indistinguishable from it. In fact, as both are the result of an overgrowth and cicatricial contraction of the interstitial tissue of the kidney, it is only to be expected that their appearances should be the same. In other cases the distinction can be readily made by the signs of the abnormal urinary pressure, which has at some time existed, such as a more or less complete destruction of the pyramids. If the cause of the urinary obstruction has been long removed, the pelvis and ureter, if they have been previously dilated, return to their normal size, so that their appearance is of little value. The mucous membrane may, however, be more or less pigmented, as the effect of previous pyelitis. Occasionally, distinct cicatrices are found on the surface of the kidney and in the capsule. It has been suggested that these are scars of former abscesses which have discharged themselves by the tubules. The evidence of this is not, however, perfect, for a cicatrix of an exactly similar kind would be left if the inflammatory process had stopped at a point at which considerable destruction of the kidney tissue had occurred, but the inflammatory products had not actually broken down into pus. In these cases of cicatricial kidney, the capsule is often found to be very firmly adherent to the surrounding fat. A kidney which has thus healed may become the seat of fresh acute attack from a recurrence of the original disease of the lower urinary passages; and, then, with the form of a contracted kidney are combined the color and other appearances of acute interstitial nephritis.

Microscopic examination of a cicatricial kidney shows merely a great excess of connective tissue between the tubules, which are in some places narrowed by the pressure of the new growth, and in others dilated in consequence of the ob-

struction at a lower point. Many obliterated Malpighian corpuscles are usually to be found in all parts of the cortex.

Etiology of Secondary Interstitial Nephritis.—Three chief causes are at work in various degrees in the production of secondary renal disease. 1. Increased pressure in the tubules from obstruction to the escape of urine. 2. Reflex irritation of the kidney. 3. The presence of septic matter in the pelvis of the kidney, and possibly in the lower parts of the tubules. All these three causes may be acting together, as is by far the most frequent case, or one may act singly. It may be broadly stated, however, that either of the first two—acting alone—rarely if ever gives rise to suppuration, although it is probable that in combination they do so. At least, cases have come under my observation in which it was difficult to find any other explanation. The last, acting alone, is doubtless capable of inducing suppuration rapidly, but it does so more easily when the kidney is already suffering from the effects of the other two.

1. *Increased Urinary Pressure.*—The effect of this in causing chronic congestion and interstitial nephritis has already been discussed.

2. *Reflex Irritation of the Kidney.*—In order to justify the insertion of reflex irritation amongst the causes of secondary renal inflammation, it is only necessary to remind the reader of those cases in which the simple passage of a catheter has been followed by complete suppression of urine and death, and of those, in which a patient suffering from some urinary affection, involving obstruction to the escape and decomposition of the secretion, has died in a few days after some simple operation, such as the introduction of a sound or lithotrite, or the passage of a bougie, acute inflammation of the kidneys being found. It is impossible in these cases not to conclude that the passage of the instrument is the direct cause of the exacerbation of the renal inflammation and of the fatal result. All other conditions remain unaltered; the passage of the instrument is the only new element introduced. In such a case also it is difficult to conceive that the introduction of septic matter on the instruments employed can have anything to do with the result, as the urine itself was before in a state of decomposition.[1] Observations have convinced me that the appearance of blood in the urine some hours after a severe opera-

[1] In order to obtain, if possible, some definite evidence of the effect upon the kidney of operations upon the urethra, I examined carefully the urine passed, as to quantity, specific gravity, blood, and the amount of urea excreted, in four cases—three of dilatation of a stricture by Holt's dilator, and one of internal urethrotomy. In each case a catheter was tied in after the operation, and the urine drawn off at intervals. In the first case, one of very old stricture, the patient passed only 15 cc. of urine in the first three hours after the operation. Its specific gravity could not be taken. The amount of urea it contained was 3·15 grms. It was clean and quite free from blood. In the following three hours 225 cc. of urine, of a specific gravity of 1024, was passed. It was darkly tinged with blood; the amount of urea was 4·725 grms. In the next three hours 160 cc. were passed still tinged with blood, specific gravity 1020. After this the quantity of urine became less, and the blood completely disappeared in twenty hours. In the second case, also of an old stricture, 250 cc. were passed in the first three hours, darkly tinged with blood. The specific gravity was 1033. The amount of urea 3·75 grms. In the next three hours the quantity fell to 190 cc., and after that there was nothing to note as to amount excreted. It remained slightly tinged with blood, uniformly mixed and free from clots, for twenty-four hours. From the fifteenth to the eighteenth hour the blood almost disappeared, but it returned in the next three hours; and during that time his temperature rose slightly from 99·2 Fahr. to 100·2 Fahr. In the third case—of Holt's dilatation—the quantity showed scarcely any variation. In the first hour 34 cc., in the second 34 cc., and in the third 30 cc.; and in the next three hours 93 cc. of urine passed. The specific gravity was 1020. The only point of interest in this case was that, although there was scarcely any bleeding at the operation, and the urine for the first hour was almost free from blood, yet the quantity steadily increased up to the end of the third hour, and disappeared at the end of the sixth hour. It was uniformly mixed with the urine, and free from clots. The fourth case—one of internal urethrotomy—was a young man who afterwards unfortunately died of pyæmia. The kidneys at the post-mortem examination were found to present scarcely any signs of disease. In this case, in the first hour the patient passed 260 cc. of pale urine, of a specific gravity of 1003, and containing 1·56 grms. of urea. In the next two hours he passed 150 cc. of a specific gravity of 1012, and containing 2·70 grms. of urea. In the next hour only 42 cc. of urine were passed, and the same hourly rate was maintained till the patient went to sleep. The urine passed in the first hour was almost free from blood; in the second and third hours the blood increased, and up to the tenth hour blood was present in sufficient quantity to render the urine dark-red, after which it diminished and had completely disappeared by the sixteenth hour. In three of these cases the quantity of urine passed was markedly increased, in one very remarkably so during the first few hours after the operation; and in one of these the increase was preceded by a period of almost total suppression. In the remaining case but little altera-

tion upon the urethra, with an increased quantity of urine, is not by any means an uncommon occurrence. The latter may sometimes be preceded by a temporary suppression. These facts point very strongly to the occurrence of a dilatation of the renal vessels, and an active congestion of the kidney, preceded probably by a contraction of the vessels and anæmia of the kidney of varying duration, in some cases so transient as hardly to be noticeable, in others sufficiently prolonged to be recognizable by the temporary cessation of the flow of urine. No conclusions could be drawn from the estimation of the urea, except that in all probability the disturbance in the kidney is purely vascular, and does not extend to the proper tissue of the gland. If such a condition of active hyperæmia be induced in a kidney already suffering from a subacute or chronic interstitial inflammation as the result of overdistension, it is easy to conceive that it may hasten the inflammatory process, and the subacute may become acute inflammation, possibly even reaching the stage of suppuration.

The trigone of the bladder and the prostatic and bulbous portions of the urethra seem to be the parts the irritation of which most directly affects the kidney; for it is extremely rare for any operation upon the penile portion of the urethra to be followed by any acute renal inflammation. These parts are very abundantly supplied with nerves, both from the sympathetic and cerebro-spinal systems. The sympathetic branches come from the hypogastric plexus, which is a direct continuation of the aortic, and the aortic is derived from the solar plexus, which also furnishes a great part of the renal plexus. There is no difficulty, therefore, in conceiving that any stimulation applied to the bladder or urethra may react directly on the kidney, causing a temporary contraction, followed by a more or less prolonged dilatation of the renal vessels. Stimulation of the sensory nerves of the bladder, which are derived from the communicating branches from the sacral spinal nerves to the pelvic plexus of the sympathetic, would also cause a dilatation of the renal vessels, but without any antecedent contraction. In stone in the bladder, and in stricture of the urethra, every time the patient passes water a more or less violent stimulation of the nerves of the bladder or urethra necessarily occurs, and it is probable that the stimulation is accompanied by a corresponding vascular disturbance of the kidney. These repeated attacks of hyperæmia, although they would be comparatively harmless in a healthy kidney, tend to aggravate any inflammatory changes that may have been set up from the other causes mentioned above.

3. *The presence of Septic Matter in the Pelvis of the Kidney.*—In the great majority of cases the presence of decomposing urine in the pelvis of the kidney is the immediate cause of the final acute attack, which terminates the chronic nephritis secondary to vesical or urethral disease; but it is an error to suppose that the presence of ammoniacal urine in the pelvis is an essential cause of suppuration in the kidney. Cases do undoubtedly occur in which suppuration occurs with acid urine in the pelvis. I have seen several myself during the past few years. It is not enough to examine the urine as passed by the patient before death, for alkalinity of the urine as it is discharged from the bladder is fortunately only accompanied by extension of the decomposition to that in the ureters and pelvis in a comparatively small proportion of cases. This is easily proved by washing out the bladder carefully, until the water that returns by the catheter is perfectly clean. Then, if the instrument be tied in for a short time, the first urine that comes away will almost always be acid. Should it be alkaline from the presence of ammonia the condition of the patient is a most serious one, as it indicates the presence of putrid urine in the pelvis of the kidney. The extension of the process of decomposition to the urine contained in the ureters is prevented, probably, by the almost constant flow of fresh urine through their narrow orifices into the bladder. This stream washes back the solid particles (whether organisms or not has no bearing on the present question) which are the cause of the ammoniacal fermentation of urine. It has before been stated that regurgitation of urine during micturition is a very rare occurrence, if it ever takes place; and some other explanation must therefore be found for the extension of decomposition from the bladder to the ureters.

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tion was observed. In every case the amount of blood steadily increased for the first few hours, and then gradually subsided. In the first case, during the period of almost total suppression, the urine was free from blood, but as the quantity increased the blood made its appearance. Was this blood from the kidney, or was it from the wound? It seems difficult to conceive that a lacerated wound, such as is produced by the forcible rupture of a stricture, could continue to bleed for so long a time. If the blood were from the wound, it is most probable that some clots would have been seen; and if it were slowly trickling back into the bladder along the outside of the catheter, it would not have been uniformly mixed with the urine. Now in all these cases no clots were seen, and the blood was uniformly mixed with the urine. It seems most probable, therefore, that the blood in these cases actually came from the kidney.

The most probable supposition is, that in consequence of the irritation to which the pelvis and the ureters are exposed in common with the kidney, from the obstruction to the free passage of the urine, a slight degree of inflammation is set up, accompanied by an increase in the secretion of mucus. If then the ureter, instead of having its mucous surface constantly clean and washed by the passing urine, is covered with a thin layer of almost stagnant mucus, it is easy to see how decomposition may spread upwards from the bladder. It is possible, also, that the catarrhal inflammation existing in the bladder may extend into the ureters by direct continuity of tissue; but this is certainly a rare occurrence, for when the opportunity occurs of examining a case of catarrhal inflammation of the bladder, in which the patient has died from some other cause than suppurative nephritis, the redness and swelling are found almost invariably not to extend beyond the orifice of the ureter. It is therefore probable that in all cases slight catarrhal pyelitis precedes the decomposition of the urine in the pelvis of the kidney; but as soon as the decomposition occurs, the pyelitis becomes greatly intensified by the irritation of the ammoniacal urine.

The exact mode in which the decomposing urine affects the kidney so as to give rise to a degree of acute inflammation incompatible with life, is a question upon which there exists much difference of opinion.

If the kidney be already suffering subacute interstitial inflammation from the other causes already mentioned, it is evident that the increased irritation set up by the presence of ammoniacal urine filling the pelvis, and giving rise to acute pyelitis, would be quite sufficient to intensify the process to such an extent as to render the kidney incapable of performing its functions. Suppurative nephritis is, however, frequently observed in kidneys in which the signs of previous disease are almost or wholly wanting, and in these cases the acute inflammation is not merely the intensification of a previous chronic process, but is the primary affection.

A most detailed account of the etiology of suppurating kidney is given by Klebs (Handbuch der pathologische Anatomie). He is the first to allude to the fact before stated that suppurative nephritis may occur, without any continuity of the inflammation with that in the bladder. This was taken by Beckmann to be a proof that the inflammation of the kidney is due to blood-poisoning. Klebs, however, states that he has discovered that it is due to the presence of minute organisms, similar to those found in decomposing urine, which find their way up from the bladder, multiply in the cortex, fill up the tubules, and then force their way into the interstitial tissue, setting up inflammation terminating in suppuration, and he proposes to give the affection the name of Parasitic Nephritis.

That organisms are to be found in the pelvis and in the tubes of the pyramids in cases in which decomposition has extended to those parts, is no doubt true, but no other pathologist has at present confirmed the observation of Klebs in all its details. I have examined many specimens with Klebs' illustrations before me, and have failed to recognize either the organisms or the primary change in the epithelium as described by him. It must also be borne in mind that observers of the very highest ability have been deceived by the appearances produced by chromic acid, and have described granules due to this reagent as micrococci.

Dr. Dickinson, in a very able paper in the Medico-Chirurgical Society's Transactions, 1873, lays great stress upon the fact that the dissemination of the intertubular inflammation is chiefly in the course of the veins. He says, "This disorder has its origin in the regurgitation of urine charged with morbific products. This, forced backward by the retention general in these cases, distends or occupies the straight ducts. Thence by transudation, or similarly, it enters the neighboring bloodvessels, and charges them with an infection resembling in its results that of pyæmia. This is distributed by the veins to the rest of the glands, sowing abscesses in their course." The theory is founded upon the almost constant association of suppurating kidney with decomposing urine, and upon the facts that clots are frequently found in the small veins of the kidney, and that the abscesses and lines of interstitial inflammation follow the course of the veins. On the other hand, as before stated, suppurative nephritis is not invariably associated with putrid urine in the pelvis of the kidney. Nor, so far as my observations go, are the clots in the vein by any means a constant occurrence. Although the chief lines of inflammation do follow the course of the veins, it must be remembered that in the same situation run the chief lymphatics, and there also the interstitial tissue is most abundant—Dr. Dickinson compares the condition to pyæmia, and suggests for the affection the name of the Uro-septic Kidney. He says, "the condition of the kidney may be described as one of pyæmia arising within itself. It has a close resemblance to that caused by a distant infection, differing from it in the usual dilatation of the urinary outlets, and in the fact that, while with pyæmia from a remote source the *materies morbi* is necessarily distributed by the arteries, in the

condition under discussion it is scattered by the veins into which it was first received." There seems, however, to be one serious objection to this theory; the veins from the pyramids do not in any way communicate with the cortex. Those from the cortex, as well as those from the pyramids, empty themselves into the large veins at the cortico-medullary junction. If, therefore, thrombosis of the small veins of the pyramids, accompanied by subsequent softening of the clot, formed an important part of the process, the broken down clots would be carried on into the larger veins, and so into the general circulation and give rise to ordinary pyæmia. It seems therefore most probable that the coagula sometimes seen in the small renal veins are the result of the diffuse inflammation going on round about them and not the cause of the spread of the process.

If therefore the structure chiefly influenced by the presence of septic matter is not the epithelium and not the vessels, there are only two tissues upon which it can be reasonably supposed to act—the connective tissue and the lymphatics; and these it is impossible to separate in any way in such an organ as the kidney. The condition is one in which the lymph spaces and lymphatic vessels would be singularly liable to be affected. The pelvis of the kidney, and probably also the straight tubules for a greater or less distance, are filled with putrid urine at some degree of pressure. The contact of this irritating fluid damages the epithelium and causes its rapid desquamation. The septic matter then passes readily through into the intertubular lymph spaces of the kidney and excites a diffuse inflammation, which spreads rapidly towards the cortex between the tubules. As the connective tissue is most abundant in the course of the interfascicular veins, that is the line in which the process extends.

It has been suggested by Dr. Goodhart of Guy's Hospital, in the *Guy's Hospital Reports*, 1875, that in some cases the diffuse inflammation may be erysipelatous in character. He brings forward some interesting evidence in favor of the possibility of such an occurrence. But erysipelas could at most only account for a very small percentage of cases, and there are no means by which its presence can be definitely proved.

Dr. George Johnson has suggested that in some cases the localized abscesses may be due to rupture of the tubules, and from the pressure to which they are exposed, and escape of the urine into the intertubular tissue. Such an occurrence is of course possible, but there is no evidence to prove that it ever happens.

Lastly, suppurative nephritis was formerly supposed to be a simple catarrhal inflammation, extending from the bladder to the urinary tubules. The microscopic appearances in the kidney are sufficient to disprove this.

Symptoms.—*Of the Chronic Interstitial Nephritis and Dilatation of the Kidney arising from increased Urinary Pressure.*—There are very few symptoms of any kind by which these conditions can be recognized during life, yet it is of great importance to the surgeon to ascertain, if possible, the exact state of the kidney before undertaking any serious operation. A sacculated kidney, although causing very little inconvenience to the patient under ordinary circumstances, is in a condition very prone to pass on into acute and fatal inflammation if exposed to the reflex irritation arising from an operation, or to the direct effect of putrid urine in the pelvis.

Secondary chronic interstitial nephritis causes no œdema, no marked anæmia, and no alteration in the function of the skin. There is no pain or tenderness in the renal region, and it is very rarely that palpation can give any information. The kidney might in some rare cases be felt to be enlarged, but it is very seldom that the dilatation proceeds to such an extent as to render this possible. In the earlier stages before much dilatation has occurred, nothing is recognizable. The examination of the urine is almost always rendered more or less difficult by the admixture of pus and mucus from the bladder, and occasionally by blood, arising in consequence of the primary disease. Under these circumstances it is sometimes possible to obtain urine of comparative purity in very small quantity by washing out the bladder with warm water, and then collecting through a catheter the first few drops that enter the bladder. The most marked change in the urine is its increase in quantity and its low specific gravity, indicating an increased blood-pressure in the Malpighian bodies, due to the obstruction of the venous circulation by the intertubular new growth. In order to ascertain this, twenty-four hours' urine must be collected, and the specific gravity of the whole taken. Great errors are likely to arise if this precaution be neglected.[1] The urine may be absolutely free from albumen. In a very typical case of simple dilatation of the kidney, arising from the pressure upon the ureters of two enormous sacculi, which projected from the bladder just behind the trigone, and

[1] In a case of lithotrity, under my care at University College Hospital, the specific gravity of the first sample of urine examined was 1003, but that of the whole twenty-four hours was 1018.

reached on one side to the liver, and on the other to the spleen, the urine was found to be perfectly clear, free from albumen and casts, and of a specific gravity of 1009. Yet in this case the post-mortem examination showed the pyramids almost destroyed, and the cortex under the microscope exhibited a high degree of corpuscular infiltration of the intertubular tissue. There was not and never had been any cystitis, and beyond the sacculi no disease was found. The patient died suddenly during the aspiration of one of the sacculi for the purposes of diagnosis. In another case of prostatic disease lately under my care in University College, the patient, for some weeks before his death, passed from five to six pints of urine daily, of a specific gravity of 1003 to 1004, and containing merely a trace of albumen. The fatal termination of this case was due to an acute attack of interstitial nephritis. These cases clearly show that the absence of albumen is no evidence that the kidney is healthy, and if relied on may lead to most fatal errors in the choice of an operation. If any casts are present they are few in number, and hyaline in character. No other renal derivatives of any importance are found in the urine. I attempted in a few cases to ascertain the condition of the kidney by estimating the excretion of urea, but I found that the increased quantity of urine passed fully made up for the small proportion of urea in each analysis, and the daily quantity excreted was, as far as could be ascertained, normal—even in patients suffering from subacute attacks of interstitial nephritis. The quantity and specific gravity are then almost the only guides we have, and they are by no means certain. It is surprising how much dilatation, and how great an amount of destruction both of the pyramids and cortex, may occur without the excretion of urine being affected so much as to impair the health of the patient. This is probably due to the fact that the part destroyed performs merely the function of a duct, and that the epithelium of the true secreting part of the kidney is but little altered.

Symptoms of Subacute Diffuse Interstitial Nephritis.—Subacute interstitial nephritis may last for weeks, or in some cases for months. It runs an irregular course, marked by occasional exacerbations and intervals of apparent recovery. The periods of improvement usually coincide with some diminution of the local irritation at the primary seat of disease. In a very typical case, secondary to disease of the prostate, with cystitis and decomposition of the urine, under my care in University College Hospital, the patient was twice admitted and sent out again, relieved of all urgent symptoms, the improvement being brought about each time by washing out the bladder with an antiseptic solution, and thus diminishing the cystitis consequent upon the ammoniacal urine. The urine passed immediately after the bladder was washed out was always acid, thus showing that the decomposition had not extended up the ureter to the kidney. This case ultimately terminated fatally from an acute attack with suppuration in the kidney. In subacute interstitial nephritis, if the attack arises as the result of some surgical operation, the commencement is usually marked by a rigor. In other cases, chills frequently occur at the beginning of the attack, and occasionally during its progress, but a distinct rigor is rare. The general health suffers considerably; the patient is weak and languid, and slowly but steadily emaciates. The tongue is covered with a dirty whitish fur, which has a great tendency to dry. The mouth is clammy, and there is frequently considerable thirst. The appetite is bad, and there is occasionally a tendency to nausea, but actual vomiting is rare. Occasionally there is diarrhœa, but by no means constantly. Examination of the kidney by palpation gives but little information. It is seldom sufficiently enlarged to be clearly felt through the abdominal walls, and there is usually no tenderness on deep pressure. There is, in fact, very little pain of any kind, and unless the patient is disturbed by some intense suffering from the primary disease, he is usually in a very placid state, almost comfortable—often drowsy, like a man slightly under the influence of opium. There is no dryness of the skin; in fact it is usually moist and clammy. The pulse presents nothing characteristic. The temperature is peculiar and very characteristic. For weeks together it may be normal or below normal, in the morning, and ranging from 99° to 101° in the evening. As an example the following may be given, taken from a case of lithotomy nearly six weeks after the operation:—

Morning.	Evening.
97·4° Fahr.	99·1° Fahr.
98·3	98·9
97·0	100·5
98·0	101·1
98·6	100·1
98·4	101·2
97·0	101·2
98·3	100·1
98·2	100·0
—	100·8
98·5	—
98·4	100·2
68·2	99·0
97·4	100·6

This patient was discharged from the hospital without any improvement of the

symptoms, and his ultimate fate could not be ascertained. An occasional observation of the temperature is valueless. In order to draw a useful conclusion, it is necessary to use the thermometer morning and evening for a few days. I have not unfrequently seen cases in which the temperature has been supposed to be normal, from the observations being made only in the morning. The evening rise is seldom great, 101° or 102° being usually the maximum If the morning temperature rises also above normal, and the evening reaches a higher point, it is to be feared that the subacute inflammation is passing on into the acute form. The urine is in most cases abundant, and of low specific gravity, especially in those cases in which obstruction to the flow of the urine has existed for a long time. Cases, however, do occur in which there is little or no alteration either in the quantity or specific gravity. The amount of albumen is not great, in most uncomplicated cases it is merely a trace; but usually the estimation of the exact amount is impossible from the admixture with the urine of pus, mucus, and blood from the bladder. Microscopic examination is also difficult for the same reason. In some cases, however, it is possible to find some few hyaline casts, and a few renal-epithelium cells; but usually they are held in suspension in the thick, ropy mucus, so that their discovery is merely a matter of chance. Occasionally casts are found with leucocytes imbedded in them. These indicate that the subacute condition is verging on the acute.

The symptoms above described may last for a long time, the patient gradually becoming weaker and weaker, until he is carried off by some intercurrent disease or dies of pure exhaustion. Much more frequently the fatal termination is due to an acute attack, usually accompanied by suppuration of the kidney, excited either by the irritation of some surgical operation, or by the extension of decomposition from the bladder upwards into the ureter and pelvis of the kidney. On the other hand, if the primary disease be relieved, and all sources of irritation removed, the symptoms may gradually subside, and the patient return apparently to perfect health.

It is often difficult when the patient is suffering much from the primary affection to ascertain with certainty how much of the constitutional disturbance is due merely to this, and how much to secondary renal mischief, especially in cases of stricture complicated with perineal abscesses. However, if we find a dry tongue, loss of appetite, a nocturnal elevation of temperature, and a history of progressive weakness and emaciation, and especially if with these the urine is abundant and of low specific gravity, a condition of subacute interstitial nephritis must be suspected, which by any injudicious surgical operation, undertaken for the relief of the primary disease, might easily be intensified to such a degree as to become incompatible with life.

Symptoms of Acute Interstitial Nephritis, or of Suppurative Nephritis.—There are no definite symptoms by which acute diffuse interstitial nephritis can without suppuration be distinguished from suppurative inflammation of the kidney; but, whenever the symptoms proceed rapidly to a fatal termination, suppuration may be suspected. The symptoms of acute inflammation often supervene on those of the subacute form just described. The immediate cause of the attack is frequently some surgical operation, such as the passage of a catheter, lithotomy, or lithotrity. An operation upon the deeper parts of the urethra is a frequent cause, but one on the anterior part, in front of the scrotum, is rarely, if ever, followed by any secondary disturbance. In other cases the attack is induced by extension of the decomposition from the bladder into the ureters and pelvis, which may be recognized by the impossibility of any longer obtaining acid urine from the bladder, even after most carefully washing out its cavity with an antiseptic. The attack commences with a violent rigor, during which the temperature rises to 105° F. to 106° F. It is followed by profuse sweating. After the rigor the temperature falls, but still remains a little above normal; and there is a regular evening rise of one or two degress. Several rigors may occur, or only one. The tongue becomes at first furred, but very soon dry, red, and fissured, looking like a piece of broiled ham, and sordes accumulate on the teeth and lips. The loss of appetite is complete, and there is almost invariably more or less nausea: actual vomiting is not of very frequent occurrence. Diarrhœa may occur, but is not usually a marked symptom. Emaciation occurs with great rapidity, a few days sufficing to make a great alteration in the patient's appearance. The skin is usually moist throughout, except during the rigors. Most frequently it is covered by a clammy perspiration. The mental condition of the patient is very peculiar. He is often in a happy, dreamy state, closely resembling the effects of opium. There is seldom any delirium, and convulsions are of great rarity. The pupils are in some cases contracted, in others of normal size. As the case advances there may be muttering delirium, the pulse becomes weaker, the patient becomes gradually insensible, and dies. There is never the profound coma so often found in death from acute Bright's disease. Before death the tem-

perature falls, and may often remain normal for the last few days of life. Occasionally the patient complains of more or less pain in the lumbar region, and there is almost invariably tenderness on deep pressure over the kidney. The urine in these cases is usually in so foul a state that accurate observation of it is impossible. It is frequently tinged with blood, and in some rare cases it is greatly diminished in quantity, or even suppressed. Much more commonly it remains abundant to the end, and contains a fair quantity of urea. In one case in which I estimated the amount of urea, I found that over 300 grains were passed on the last day of life. The amount of albumen varies much, but it is usually moderate in amount, unless blood or pus is present in large quantities. The microscope shows the presence of renal epithelium in considerable abundance, with bladder epithelium, pus, and blood-corpuscles. Occasionally, casts may be found. These are usually hyaline, but may be granular. In some rare cases pus casts may be observed.

It will be seen that, although the patient dies directly from the acute inflammation of the kidney, the symptoms do not resemble in any respect those of acute Bright's disease. There are no convulsions, no coma, no œdema, no dryness of the skin; and the urine, instead of being scanty and dark-red in color, is usually abundant and only faintly tinged with blood. On the other hand the symptoms closely resemble, and in fact are often indistinguishable from, those of septicæmia. There is the preliminary rigor, the brown dry tongue, the rapid emaciation, the temperature high at first gradually falling below normal, the occasional diarrhœa, the drowsy condition, and gradually increasing insensibility without coma before death. In some cases also the skin may assume a yellowish tint. At the same time, the secretion of urine continues in fair quantity, and the patient cannot therefore be said properly to die of uræmia. It seems most probable that the death is in reality due to septicæmia, the septic matter being absorbed by the veins and lymphatics of the kidney in sufficient amount to cause death, while at the same time the power of elimination of the poison is more or less limited by the state of the kidney.

In some exceptional cases diarrhœa forms a very prominent symptom. In a young man, aged thirty, under treatment for stricture in University College Hospital, the most marked feature was profuse diarrhœa exactly resembling that of typhoid fever. The temperature, however, remained constantly below normal for ten days before death. The post-mortem examination showed the mucous membrane of the intestine, from the stomach onwards, in a state of intense congestion. The lower part of the ileum was extensively ulcerated. The ulcers were not confined to Peyer's patches, many were transverse in direction, and the edges were not undermined. Both kidneys were suppurating, but there was scarcely a trace of pyelitis.

Another variety of the disease is described by Malherbe in his admirable treatise on uræmic fever, in which abscesses, containing pus of a urinous odor, are found in the intermuscular connective tissue, in the subcutaneous tissue, and various other parts. It has not fallen to my lot to see such a case, and it seems doubtful whether the condition is not in reality a form of pyæmia.

The duration of acute interstitial nephritis is seldom more than two weeks, and it is very frequently fatal in a shorter time. Recovery not unfrequently takes place even after symptoms of a very severe character have set in. In a case of this kind which I had the opportunity of observing, in which lithotrity was followed by marked symptoms of acute interstitial nephritis, the patient suffered for two years from occasional attacks of vomiting, with drowsiness and pain in the back preceded by rigors. I never had the opportunity of examining the urine during these attacks, but they were apparently due to acute congestion of the kidney. They were always attributable directly to exposure to cold. The intervals between the attacks became longer and longer, and finally they ceased altogether, and for many years the patient has been in excellent health.

It will be seen that the above description of the symptoms of acute and subacute nephritis includes all those spoken of by various authors as belonging to urethral or uræmic fever. It is not the place here to discuss the dozen or more theories which have been invented to explain this febrile disturbance, which so commonly follows all operations involving the bladder, prostate, or bulbous portion of the urethra. All those which attribute the disturbance to the passage of the urine over a raw surface, absorption of urine from the wounded part, or absorption of septic matter, are rendered improbable by the fact that operations in front of the bulb very rarely if ever give rise to rigors and fever. The most probable explanation of the symptoms is that the irritation of the nerves of the bladder or urethra caused by the operation is reflected to the kidney. As the nerves of these parts are chiefly from the sympathetic system, the stimulation is followed by a contraction of the vessels of the kidney, giving way after a time to dilatation, slowly increasing till the kidney is in a state of active conges-

tion. As the dilatation of the renal vessels takes place there is a corresponding contraction of the vessels of the skin, and hence the sensation of cold culminating in a rigor, in part also the elevation of temperature. The intimate relation between the skin and the kidneys is probably maintained by the vaso-motor nervous mechanism. Contraction of the vessels of the skin is accompanied by a dilatation of the vessels of the kidney, and there is therefore nothing unreasonable in supposing the converse, that a dilatation of the renal arteries may cause a contraction of the vessels of the skin. Moreover, direct evidence was adduced in a former part of this article to show that there is good reason to believe that mechanical violence to the urethra or bladder causes dilatation of the renal vessels and acute hyperæmia of the kidney. If the kidney be healthy the congestion soon relieves itself by an increase in the flow of urine, and no evil consequences result; but if it be already suffering from chronic interstitial nephritis, with more or less venous obstruction, such engorgement of the vessels may take place as to lead to complete blocking and stasis, accompanied either by suppression of urine or the excretion of a very small quantity darkly tinged with blood. In other cases the attack of acute hyperæmia may aggravate the existing inflammation, and the subacute nephritis may rapidly become acute.

Suppression of urine after operations upon the urinary organs is of rare occurrence; and, although many cases have been recorded, there are few in which a microscopical examination of the kidney has been made after death. It is probable that in all cases the kidney is extensively diseased before the operation. A case lately occurred in University College Hospital in which I had the opportunity of examining the kidneys after death. In this case perineal section was performed for a very old and intractable stricture. Eleven hours after the patient had a violent rigor; the temperature having risen from 99·6° F. to 102° F. since the operation. In the first twelve hours about half a pint of urine escaped into the bed, and from that time till his death on the third day no urine was passed. At the post-mortem examination the bladder was found to be empty. The kidneys were large, tough, and pale in color, having the ordinary appearance of subacute interstitial inflammation. Microscopic examination showed abundant small round-cell infiltration of the intertubular tissue throughout the kidney. The vessels were not engorged with blood. The epithelium was a little swollen and granular, but the nuclei of the cells stood out clearly, and the lumen of the tubules was not choked. It was evident that the cause of the suppression was not the obstruction of the tubules by altered epithelium, and must therefore have been due to some alteration in the supply of blood. It is impossible to conceive that it was due to a prolonged spasm of the arteries lasting for three days, or to such a general lowering of the blood-pressure that fluid ceased to flow through the walls of the Malpighian vessels. The absence of vascular engorgement after death would negative the supposition that it was due to choking of the renal vessels during an attack of acute congestion, and the only conclusion that can be arrived at is that during the first few hours the renal vessels became dilated, and that in consequence of this so great an intertubular exudation took place as to compress the small arteries to such an extent as greatly to lower the blood-pressure in the Malpighian tufts. At the same time the tubules would be also compressed, so that if any fluid passed into them from the Malpighian tufts its passage downwards would be obstructed. Thus by lowering the blood-pressure in the vessels and increasing the urinary-pressure in the tubules, the two soon become equal, and all flow from the Malpighian tufts must have ceased. With such an amount of disturbance in the vascular supply it is not possible that the epithelium could continue to perform its excretory function, and thus complete suppression of urine would result.

In other cases, however, far from being anæmic, the kidney has been found to be intensely congested, and the tubules to contain extravasated blood. In this form the suppression of urine would be due to such an amount of engorgement of the vessels of a kidney already diseased as to lead to complete stasis.

Diagnosis.—The diagnosis of the effects of simple pressure has already been sufficiently alluded to. As it gives rise to few marked symptoms, it is not likely to be mistaken for any other disease, the only danger is that it should be overlooked.

The subacute form of interstitial nephritis may be mistaken for the effects of the irritation, pain and want of rest, caused by the primary disease; and, possibly, for chronic blood poisoning from absorption of septic matter from the bladder. These errors can only be avoided by carefully examining the urine, if it can be collected, as to quantity and specific gravity, albumen and casts, and by the observation of the morning and evening temperature for a few days. If the quantity is large, the specific gravity low, the albumen small in amount; if a few hyaline casts, and possibly renal epithelium, are present; and if the temperature shows a regular and marked evening rise, while

in the mornings it is normal or nearly so, there will be strong reasons to believe that subacute interstitial nephritis exists. The progressive emaciation, feeble appetite, thirst, dry tongue, tendency to nausea, and occasional chills are also valuable diagnostic signs. Acute interstitial nephritis, with or without suppuration, may be mistaken most commonly for pyæmia or septicæmia. It may in some cases resemble septic peritonitis or typhoid fever. From *pyæmia* it may be distinguished by the absence of secondary abscesses in the ordinary parts in which they occur in this disease. The temperature also usually falls below normal, or nearly to normal, some days before death, while in pyæmia it remains high till death. The rigor may be single or multiple in both diseases. From *septicæmia* the diagnosis is often impossible. In fact, as before stated, in many cases the real cause of death is not the damage to the kidney, for the excretion of urine remains abundant to the last, but absorption of septic matter from the abscesses or from the putrid urine in the pelvis. The drowsy state of the patient, the tenderness and pain in the loins, the comparatively early fall in the temperature, and the vomiting, may serve to point to the nature of the case, but the diagnosis must in most cases be somewhat uncertain. Septicæmia is not, however, a common occurrence except as a result of septic inflammation of the kidney, and errors in diagnosis cannot frequently occur. It is only in very rare and anomalous cases, complicated with much diarrhœa, that the symptoms resemble those of *typhoid fever;* and the diagnosis is readily made by the temperature, which usually falls to normal some days before death, and is seldom so high as that of typhoid fever. The absence of spots, the tendency to vomiting, the early period at which the tongue becomes dry and brown, also serve as valuable distinctive features. Occasionally the disease closely resembles that form of *peritonitis* which arises from the presence of septic matter in the peritoneum, that is to say, in which the symptoms of septicæmia caused by absorption of the infective products mask the ordinary signs of inflammation of the peritoneum. Such peritonitis may arise from perforation of the bladder. In such cases there is no rigor, the pain is usually greater, and the vomiting is more severe than in acute suppurative nephritis.

Patients who have at some time suffered from *ague* are very liable to the occurrence of rigors after operation on the urinary organs. In such cases there is therefore additional difficulty in making a diagnosis.

Prognosis.—In the chronic forms of secondary renal disease the prognosis depends much more on the primary than on the secondary affection. If the original disease is curable, the patient may apparently completely recover. In reality, however, the structure of the kidney is always somewhat damaged, and it is left in a condition resembling the ordinary granular contracted kidney. In this state, exposure to cold or other causes of renal congestion may light up fresh disease.

In the subacute forms, if the primary cause be removable the prognosis is not bad, but there is always the danger that the necessary operation may light up acute inflammation which may rapidly prove fatal. If the primary cause be not removable, the case will certainly terminate fatally before very long. Most likely after various exacerbations and partial recoveries, an acute attack will end in suppuration of the kidney and death. The acute forms are always very dangerous, drowsiness, vomiting, a very dry tongue, much tenderness in the loins, and an abnormally low temperature are all very grave signs—if the urine is very foul, and the bladder cannot be cleansed by washing it out, the prognosis is very bad. Suppression of urine, if lasting over one day, is almost always fatal.

In the so-called urethral fever, in which the whole affection consists merely of acute congestion of the kidney following an operation on the urinary organs, there is little danger if the temperature returns to the normal soon after the hot stage of the rigor. The longer the symptoms last the more reason there is to fear that there is serious structural change in the kidney in addition to the temporary hyperæmia.

Treatment.—The treatment of the acute and even of the subacute varieties of interstitial nephritis is so unsatisfactory that every effort should be made to prevent their occurrence. The three great causes of secondary renal mischief should therefore be constantly borne in mind—increased urinary pressure from obstruction to the flow of urine, reflex irritation from the bladder or urethra, and decomposition of urine extending to the ureter and pelvis of the kidney. Almost without exception the causes of urinary obstruction require operative interference for their relief, and consequently, in order to remove the first cause of disease, the second must necessarily be more or less called into action; and as there is every reason to believe that the causes of decomposition of the urine come from without, and are in fact organisms which find their way to the bladder, and set up fermentative changes, the third may also be brought into play at the same time. The amount of irritation caused by the different operations on the urethra or bladder varies greatly. Thus the simple passage

of a bougie causes less disturbance than the forcible dilatation of a stricture, or than internal urethrotomy; and the use of soft instruments which can scarcely injure the walls of the urethra less than the passage of metallic catheters. The surgeon, therefore, whenever he has a choice, should employ that mode of treatment which involves least mechanical violence to the part operated on. The operation should also be of as short duration as possible. In cases of stone in the bladder, the relief given by lithotomy is so complete, that it is often safer, when the kidneys are known to be diseased, to risk the single violent irritation of lithotomy than to expose the patient to the repeated and prolonged disturbance caused by lithotrity. Decomposition of the urine should if possible be prevented, and as there is no doubt that the causes of decomposition are frequently introduced on the catheter, all instruments should be kept scrupulously clean, and the oil used should contain one-twelfth part of carbolic acid. Decomposition however does occur in cases in which no instrument has been used, but only when cystitis is present. This is not difficult to explain on the germ theory of decomposition. In health the urethra is washed out thoroughly at each time that urine is passed, and in the intervals is a closed tube just moistened by a trace of healthy mucus; but in cystitis the ropy tenacious mucus, coming away at the end of micturition, leaves a layer adherent to the walls of the urethra, which is not washed cleanly out by the subsequent acts of micturition, and in which at the temperature of the body organisms will develop with the greatest rapidity; and by this means they find an introduction to the bladder. It is very difficult therefore, when there is much cystitis, to prevent ammoniacal fermentation taking place. If then it cannot be prevented, it must be limited as far as possible by washing out the bladder at least twice a day with some antiseptic solution. A very useful solution for this purpose is sulphate of quinine, gr. ij, and dilute sulphuric acid, ♏ij, to one ounce of water. Carbolic acid is usually too irritating, as, in order to be effectual, it must be used in the proportion of one part to fifty of water. Condy's fluid is often very useful, but its effects are not so good as those of quinine.

It is most important that no operation, unless it be one of emergency, should be undertaken while the patient is suffering from subacute interstitial nephritis. If possible, in every case of urethral or vesical disease, the urine should be collected for the twenty-four hours and carefully examined as to quantity, specific gravity, albumen, &c. This should be repeated for two or three days, and at the same time the morning and evening temperature should be observed. If any reason is found to suspect renal mischief, the patient should be confined to bed, the bowels should be well opened, and the skin should be made to act by hot baths or vapor-baths. A mustard plaster might also be applied over the loins. He should be kept on moderate diet, and stimulants as far as possible excluded. No drug could be of any special value. If the urine is foul the bladder should be washed out regularly, if the catheter can be passed easily, as the passage of the instrument is less likely to do harm than the presence of decomposing urine in the bladder. Under this treatment the symptoms will frequently, in a few days or a week, so far subside as to render the operation safe. After the operation in such cases the patient should be wrapped up warmly in bed, to promote as far as possible the action of the skin. Quinine, opium, eucalyptus globulus, and many other drugs have been recommended to prevent the occurrence of the so-called "urethral fever" which often follows operations on such cases. I cannot say that I have ever seen the least benefit from any, except perhaps from opium, which, by increasing the action of the skin, tends to relieve the congestion of the kidney.

When the symptoms of acute interstitial nephritis are well marked, treatment is often of but little use. Hot baths, wet packing, or vapor baths should be employed to promote the action of the skin; dry cupping, or if the patient be very strong, wet cupping over the kidneys, followed by hot fomentations, should be tried. The bowels should be gently acted on by purgatives, unless there is already diarrhœa. Opium may in many cases be given without danger; and if the patient is suffering pain, should always be employed. Quinine has been given as in septicæmia, but its use has not proved of any special service. No operation beyond the passage of a catheter when necessary, either to draw off the urine or wash out the bladder, should ever be undertaken. Heroic operations performed during acute interstitial nephritis, with a view of relieving local irritation, are invariably fatal.

CALCULOUS DISEASE OF THE KIDNEY.

By W. R. Basham, M.D., F.R.C.P., and Frederic T. Roberts, M.D., F.R.C.P.[1]

Definition. — A renal calculus or "stone" is a concretion formed in some part of the kidney, varying in its size and other characters, as well as in its composition, but larger than the minute formations which constitute what is generally known as "gravel." A distinction has been made by French writers between "gravel stones" and "true renal stones," the former being of such a size that they are able to pass through the urinary passages; but no such artificial line of demarcation is of any practical advantage. A calculus, if it does not escape by the ureter, tends to set up various morbid conditions, the most important being congestion or inflammation of the substance of the kidney—*calculous nephritis;* inflammation of its infundibulum and pelvis—*calculous pyelitis;* or a combination of these lesions—*pyelo-nephritis.* Ultimately the renal structure may be entirely destroyed. The symptoms may merely indicate functional disturbance of the kidneys, or local mechanical irritation; or they arise from the passage of the calculus along the ureter; or they may be the result of the lesions which it originates; and they vary accordingly. In exceptional instances the stone becomes so encysted and encapsuled as to prove harmless, and to give no clinical sign of its presence.

Synonyms.—Renal Calculus; Stone in the Kidney; Nephro-lithiasis; Calculi Renum.

Pathology and Etiology.—By far the larger number of urinary calculi are formed originally in connection with the kidney (according to Heller the proportion is 100 to 1), and those which are found in the bladder have generally passed along the ureter from the renal pelvis to this viscus. Their formation may commence either in the uriniferous tubules, where they may remain permanently, or in the calices, infundibulum, or pelvis of the kidney. When the concretion starts in the substance of the kidney, it is usually, when still minute in size, conveyed by the urine into the pelvis of this organ, where it subsequently becomes enlarged by a continued deposit upon its surface.

The precise pathology of the formation of renal calculi is still not satisfactorily settled, but no doubt it differs in different cases, and the proximate cause may probably be referred to one or more of the following conditions: 1. The urine may contain an excess of one of its normal constituents, a portion of which is under favorable circumstances deposited, so as to originate a concretion. Thus there may be an undue proportion of uric acid, urates, or oxalate of lime, which leads to the precipitation of either of these substances, and the production of corresponding calculi. 2. The proportion of the ordinary urinary ingredients which are liable to form calculi being within the normal limits, the conditions of the urine may be such that it cannot retain one or other of these in solution. This may depend on its reaction. Thus highly acid urine is an imperfect solvent of uric acid and urates, which may accordingly be precipitated. This undue acidity has been attributed to the presence of an excess of acid bi-phosphate of soda, withdrawing soda from the urate; or to acid fermentation in the urine, with decomposition of its coloring and extractive matters. In rare instances also urine which is alkaline from the presence of fixed alkalies deposits basic phosphate of lime or carbonate of lime; while an alkaline condition of this excretion, due to its decomposition and the consequent production of carbonate of ammonia, is very liable to lead to the precipitation of other varieties of phosphate of lime, as well as of ammonio-magnesian phosphate, mixed with a small quantity of urates and carbonate of lime, and although this usually happens in the bladder, it occasionally occurs in connection with the kidney. Again it has been affirmed by Heller that a deficient amount of chloride of sodium or of alkaline phosphates in the urine diminishes its solvent power over uric acid and urates, and thus favors their precipitation. A low temperature of the urine has been supposed to have some influence in favor-

[1] This article was left in an imperfect and unfinished state by the late Dr. Basham, and has been revised and completed by Dr. Frederic T. Roberts.—Editor.

ing the development of calculi in old people. 3. In very exceptional cases the urine contains some abnormal constituent, which is but slightly soluble, and therefore is readily deposited. The most important substance which may thus form a calculus is cystine, of which in extremely rare instances renal calculi are found to consist. Examples are recorded by Dr. Church,[1] where the calculus was covered with a thick layer of viscid muco-purulent material, in which were numerous plates of cholesterine; and by Dr. Leared.[2] Still more rarely xanthine is present in the urine, and forms a calculus. 4. An important element in the origination of, at any rate, a large number of renal calculi is the presence of some material, either forming a nucleus upon which the one or other of the urinary constituents is deposited; or with which they combine from the very outset; this combination determining their precipitation. Indeed, it has come to be a question whether the primary formation of a calculus is ever due to mere precipitation, or whether there is not always a basis of animal matter which causes the first separation of the urinary ingredient by which the nucleus of the stone is originated. Occasionally a distinct nucleus of coagulated blood, or of inspissated mucus or pus, is found in the centre of a calculus, to which this evidently owes its development. Dr. Curnow[3] has described calculi of oxalate of lime, each having a large nucleus of blood-clot, and which he therefore considered were sequential to one or more attacks of renal hæmaturia. In rare instances entire concretions seem to be formed of coagulated and decolorized blood. Casts in the renal tubules have been credited with the origin of calculi, forming points for the deposit of crystals, especially those of oxalate of lime. Greisinger also found the eggs of the *Bilharzia Hæmatobia* forming the nucleus of a stone in Egypt, and these have been supposed to account for the frequency of calculous disease in that country. Dr. William Roberts suggests that the little clumps of urate of soda which are not uncommonly deposited in the urinary passages in connection with the febrile complaints of infants and young children, may be retained in the pelvis of the kidney, and become the nucleus of future calculi. With reference to the influence exercised by a basis of animal matter in laying the earliest foundation for the development of renal calculi, important observations have been made, especially by Dr. Vandyke Carter,[4] and Dr. Ord,[1] founded on the structure of these concretions, as revealed by microscopic examinations. Mr. Rainey[2] showed that in the shells of animals the mineral salts are precipitated in certain forms incorporated with animal matter, and he produced similar deposits artificially, by mixing saline solutions with organic substances, the process being termed by him "molecular coalescence." Dr. Carter has endeavored to explain the production of renal calculi in a similar manner, having found the forms of mineral deposit to coincide with those observed by Rainey. The researches of this observer, as well as those made by Ord, have revealed the fact that globular forms, and not ordinary crystals, are produced when mineral salts are slowly precipitated in a colloid medium. In his investigations Carter found that the nucleus of a calculus almost always consists of these globular forms of urates or oxalate of lime, and that it also contains a colloid matrix. Hence the theory that many calculi at any rate originate in the presence of a little mucus or other colloid substance in some part of the renal apparatus, with which urates or oxalate of lime become mixed, and these are then precipitated in a globular form.

A calculus having once been started, it increases in size by a continued deposit upon its surface, this usually assuming a stratified arrangement. The layers may consist of a similar material, so that the stone is uniform in its composition, though the nucleus is often different from the subsequent deposit; or two or more substances may alternate more or less regularly. In the great majority of instances the deposits are *primary*, that is, they are composed of ingredients separated from the urine as it is first excreted; it may happen, however, that a calculus having remained in the renal pelvis, and having set up pyelitis, while at the same time the urine is retained in this part, the products of inflammation cause this fluid to decompose and to become ammoniacal, under which circumstances, as already pointed out, calcic and ammonio-magnesic phosphates are precipitated, which form what are termed *secondary* deposits. The size to which a stone may thus attain is very considerable, and it may ultimately cause complete destruction and obliteration of the renal apparatus.

Having thus far discussed the conditions under which renal calculi are formed, it remains to be considered what causes originate, or predispose to these conditions.

[1] Pathological Transactions, vol. xx. p. 240.
[2] Ibid. vol. xxiii. p. 165.
[3] Ibid. vol. xxiv. p. 148.
[4] On the Microscopic Structure of Urinary Calculi. London: 1873.

[1] Medico-Chirurgical Transactions, 1875, and Quarterly Journal of Microscopic Science, vol. xii. new series, p. 219.
[2] On the Mode of Formation of Shells, &c. London: 1858.

1. *Hereditary Influence.*—The tendency to the development of calculi seems to be in many instances hereditary, and this especially applies to certain varieties, particularly the cystine-calculus, though it is not always possible to trace family predisposition even in this form, as in the case already mentioned which is recorded by Dr. Leared. The hereditary tendency is presumed to depend upon a peculiar diathesis or constitutional condition, and in past times each variety of calculus was attributed to a special diathesis—the uric or lithic acid diathesis, the oxalic acid diathesis, &c. That a condition of system favorable to the excessive formation of these products may be transmitted cannot be doubted, and it probably accounts for a certain proportion of cases of renal stone. This is one of the pathological consequences of the gouty constitution.

2. *Age.*—Calculus is of much greater frequency during childhood than at other periods of life. It may be found even in the fœtus. The disease is most common under five years of age; next from this period until about fifteen; after this its frequency diminishes until middle life, but subsequently as age advances it again becomes more prevalent until about sixty-five, when the proportion of cases becomes once more lessened.

3. *Sex.*—Males are much more liable to calculus than females, and the proportion of deaths in the former is also much greater. This statement applies both to children and to adults.

4. *Habits of Life.*—There can be no doubt but that excessive eating, especially of meat and other highly-nitrogenized food, over-indulgence in alcoholic drinks, want of exercise, and an indolent and sluggish mode of living, with other habits which tend to develop the gouty condition, and to lead to the formation of excess of urates and oxalates, materially assist in the causation of renal calculus in some cases. This accounts for the comparative frequency of uric acid calculus among the better classes after middle life. At the same time too much stress must not be laid on these conditions, as the complaint frequently occurs under totally opposite circumstances, and it must be borne in mind that a stone may be formed when there is no excess of its constituents in the urine. Oxalate of lime calculus has been attributed to the excessive consumption of vegetables containing an abundance of oxalates, especially rhubarb and sorrel.

5. *Climate and Locality.*—It is found that renal calculus occurs in every variety of climate. Formerly it was believed to be chiefly met with in damp and cold climates, and that it did not occur in tropical regions. The complaint has, however, been found to exist largely in India and other hot climates, and therefore such a notion is proved to be incorrect, no region being exempt from the disease. At the same time it does prevail more in certain countries and districts. The disease is common in England, especially in the eastern counties of Norfolk and Suffolk, and next in the north-midland counties. Dr. William Roberts[1] gives the following as the proportion of deaths (in males) from stone in each of the eleven registration districts of England and Wales, for every 100,000 deaths from all causes, in the ten years, 1857–1866:—North-Western 34; South-Western 46; Northern 54; West-Midland 64; South-Midland 71; Yorkshire 75; London 90; Monmouthshire and Wales 91; South-Eastern 93; North-Midland 98; Eastern 115. Stone is also prevalent in France, Iceland, Egypt, and the Netherlands, though less so in the last-mentioned than formerly. The complaint is rare in Sweden and Norway. The endemic occurrence of calculus in some districts has been attributed to the use of drinking-water containing an undue proportion of lime-salts, and the influence of such water in originating stone has been extensively believed in; but there seems to be no adequate foundation for such a belief.

6. *Renal Disease.*—Previous disease in connection with the kidney may have considerable influence in originating a calculus. For instance, such a disease may cause hemorrhage, and thus give rise to a clot forming a nucleus; or there may be catarrh of the uriniferous ducts, or more or less pyelitis, leading to the production of mucus or pus, which determines the precipitation of the constituents of the urine, thus forming the basis of a stone.

Anatomical Characters.—This part of the subject may be discussed under the following heads:—

1. The general description of a renal calculus.
2. The description of its several varieties.
3. The direct effects which stone is liable to produce on the renal apparatus or neighboring structures.
4. Its remote effects and complications.

1. *General Description.*—A renal calculus is usually more or less oval or circular in shape, but it may be irregular or branched if it is long retained, becoming moulded to the interior of the renal outlet. Much variety is presented as to size, number, condition of the surface, color, degree of hardness, and other characters,

[1] Urinary and Renal Diseases, 3d edition, 1876, pp. 272, 273.

these depending to a great extent on the nature of the concretions. On section it is generally seen to consist of a *nucleus* in the centre, outside which is the *body*, with, in exceptional instances, a still more superficial deposit, made up of secondary phosphates, and termed the *crust*. As a rule a concentric stratified arrangement is evident, the strata varying much in number and thickness, the one bearing an inverse proportion to the other, while they may present similar or different characters, and regularly alternating layers of different composition may be observed. Sometimes the layers are slightly wavy. Occasionally the structure is in the form of lines radiating from the centre, or the concentric and radiating arrangements may be more or less combined. In some calculi no regular structure is discernible. The *chemical composition* varies according to the nature of the stone, and when the strata are made up of different constituents, this is of course revealed by the chemical analysis. The nucleus may or may not be of the same composition as the remainder of the calculus. There is always a certain proportion of organic matter mingled with the essential constituent or constituents of which the several varieties of renal stone are composed.

2. *Varieties of Renal Calculi.*—The following are the varieties of renal stone met with, named according to their composition, the more prominent characters of which it will now be desirable to describe:—(*a*) *Uric Acid;* (*b*) *Urates*, especially urate of ammonia; (*c*) *Oxalate of Lime*—the so-called *Mulberry Calculus;* (*d*) *Phosphates;* (*e*) *Carbonate of Lime;* (*f*) *Cystine;* (*g*) *Xanthine;* (*h*) *Fibrin or Blood;* (*i*) *Mixed.*

(*a*) *Uric Acid.*—By far the largest proportion of renal calculi consists of this substance, of which it has been calculated that five-sixths of these concretions are made up. This is explained by its being such a very sparingly soluble substance; and although it may be met with at all ages, this variety of calculus is especially common after middle life, and is frequently associated with the gouty condition. Uric acid calculi are often very numerous. They vary much in size and weight, ranging from minute concretions, which border upon gravel, to a mass completely filling the renal pelvis. Usually they weigh from a drachm to an ounce, but may be much heavier than this. They are hard and dense, their specific gravity being about 1·5. In shape they are generally oval and elongated, or rounded, and more or less flattened. The surface is minutely tuberculated or mammillated. The color varies according to the admixture of pigments: thus it may be light fawn, brick-red, or vermilion, or in exceptional instances red-dish-brown or greenish. The broken surface presents usually a crystalline appearance in the smaller concretions, an amorphous one in the larger, which also have a peculiar wooden aspect. A concentric arrangement is evident, and the layers may be of different colors. Chemically uric acid calculi are characterized by being soluble in a very weak solution of carbonate of potash or soda, but insoluble in water, strong solutions of the alkaline carbonates, or dilute mineral acids. Uric acid is readily recognized by the *murexid test.*

[Fig. 92.

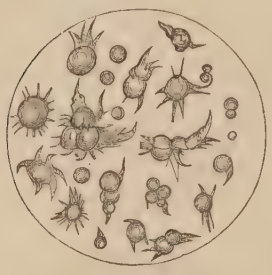
Uric acid calculus (section).]

(*b*) *Urates.*—These consist mainly, but not entirely, of urate of ammonia. Calculi made up wholly of urates are rare, and are almost limited to young children; but the nucleus of other calculi is frequently thus constituted. This variety of stone is in the form of soft, irregular concretions, which are characterized chemically by being soluble in hot water.

(*c*) *Oxalate of Lime.—Mulberry Calculus.*—This substance rarely forms the whole of a stone, but generally alternates with layers of urates. Calculi of oxalate of lime are never so numerous as those of uric acid, and there may be but one, or several may be present. In the case already mentioned, which is recorded in the Pathological Transactions by Dr. Curnow, there were several calculi in both kidneys, consisting externally of pure oxalate of lime, with a large nucleus of blood-clot. In size they vary considerably, from not larger than a hemp-seed to concretions of some dimensions. Their general outline is more or less round, or occasionally oval; but the surface is in the great majority of instances very rough and irregular, and hence they have been likened to a mulberry, though the

irregularities are more often warty or thorny, or the oxalate may be deposited mainly in beautiful crystals, as in a case

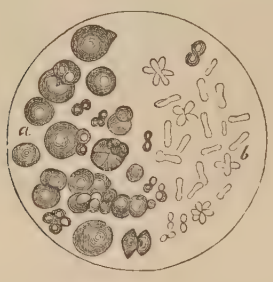
[Fig. 93.



Urate of ammonium.]

recorded by Dr. Church.[1] This superficial roughness causes much irritation, and leads to hemorrhage. Hence oxalate

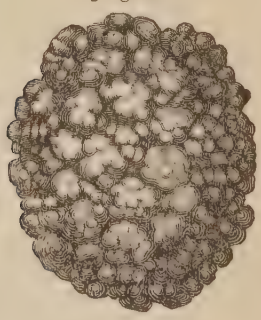
[Fig. 94.



Urate of sodium.]

of lime calculi are of a dark, grayish-brown color, or even blackish-brown, owing to the admixture of altered blood

[Fig. 95.

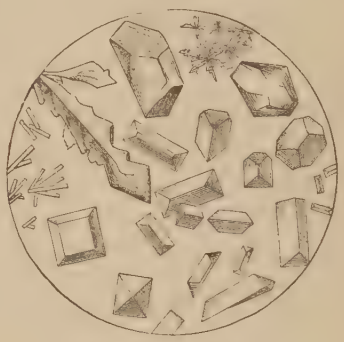


Mulberry calculus.]

pigment. They are remarkably hard, and break into angular pieces when crushed. The fractured surface is almost always amorphous, and presents concentric laminæ. Chemically a mulberry calculus is characterized by being soluble in mineral acids, but insoluble in organic acids and alkaline carbonates. By the action of the blowpipe it is first blackened, and ultimately reduced to lime, the oxalate being converted into carbonate, and the carbonic anhydride then driven off.

(*d*) *Phosphates.* — Primary concretions of calcic phosphates are not common. *Basic phosphate of lime* or *bone-earth* occasionally forms an entire calculus, or, in still rarer specimens, alternates with uric acid, as in one which is in the museum of

[Fig. 96.



Triple phosphate.]

the Manchester Infirmary, alluded to by Dr. William Roberts. Stones of this nature may be numerous. They differ much in size, but may attain that of an ordinary hen's egg. Their color is white or yellowish-white; and the surface is smooth or roughish. They present different degrees of hardness, and their texture is either loose or compact. The broken surface always presents an amorphous, earthy, or chalky appearance. *Ammonio-magnesium phosphate* very rarely forms other than minute concretions, which are remarkably white, rough superficially, and of moderate hardness, the fractured surface being granular, yet crystalline and radiated. Renal calculi may consist of a mixture of *phosphates of lime* and *ammonio-magnesian phosphate*, constituting the so-called *fusible calculus*, though this variety is chiefly found in the bladder. As a primary concretion it is extremely exceptional, and is said to be chiefly observed in old people. The mixed phosphates may be deposited secondarily on a calculus retained in the renal pelvis, thus forming its superficial portion; and such a stone may grow to a very large size, and may become very irregular in shape. The surface may be studded with crystals of triple phosphate. Calculi of this nature are white and chalky-looking, of a loose and friable texture, and a section is either

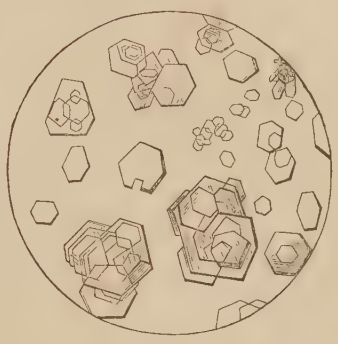
[1] Pathological Transactions, vol. xx. p. 239.

laminated or irregular. These concretions are insoluble in water and alkalies, but dissolve readily in mineral and other acids, though without effervescence, and they cannot be burned away with the aid of the blowpipe, but under a strong heat fuse into a substance like enamel.

(*e*) *Carbonate of Lime.*—Calculi composed of this ingredient are extremely rare in man, but are said to be not uncommon in herbivora. They were formerly supposed to be prostatic calculi, but their formation in the kidney has been undoubtedly established. Dr. William Roberts[1] quotes a case of his own, and also one of Dr. Haldane's, in which a large number of small concretions of carbonate of lime were found. Usually these calculi are very minute, being almost like gravel, and they are seldom larger than a hazel-nut. They are generally spherical, smooth on the surface, of variable color—yellowish, gray, or bronze-color, sometimes with a metallic lustre, and usually very hard. They are easily soluble in mineral acids, with effervescence, in consequence of the escape of carbonic anhydride; acetic acids act slowly upon them, dissolving the carbonate, and leaving behind an animal matrix; they are not affected by caustic potash; and their surface becomes covered with a brilliant iron-gray enamel when they are heated to whiteness before the blowpipe.

(*f*) *Cystine.*—This form of concretion is also very rare, but when it does occur it is usually made up entirely of cystine. The size and weight vary much; and the calculi are generally elongated, being cylindrical or egg-shaped. The specimens already alluded to, which were exhibited before the Pathological Society by Dr. Leared, ranged in size from that of a millet-seed to a flattened pea, but were rough and irregular in shape. One shown by Dr. Church,[2] removed from the pelvis of the right kidney of a man, aged fifty, was very irregularly-shaped, and weighed, when dry, 59 grains, after some had been used for analysis. Cystine calculi are of a dull-yellow color, which frequently, but not invariably, changes to a pale emerald-green on exposure to the air; and the surface is lustrous or covered with crystals. They are easily friable, and can be scraped with the nail. A section presents a radiated structure, with a certain degree of transparency and brilliancy. Cystine calculi are soluble in fixed alkalies and their carbonates, in mineral acids, and in ammonia. From the latter solution characteristic six-sided crystals of cystine are deposited on evaporation after exposure; it may also be recognized by its chemical tests. Calculi made up of cystine yield a large proportion of sulphur.

[Fig. 97.



Cystine.]

(*g*) *Xanthine.*—This constitutes one of the rarest varieties of calculus, specimens being mere curiosities. A stone composed of xanthine is light or dark brown, or deep yellow, smooth, and hard. It may be partly bright, and on rubbing assumes a waxy lustre. Its size and weight vary widely, the concretion in most recorded instances having been very small, but there is a specimen in the Museum of the College of Surgeons weighing ninety grains, and Langenbeck removed a xanthine calculus as large as a small egg. This substance was first discovered in a stone by Dr. Marcet in 1817. It is soluble in alkalies, but not in carbonate of potash. It also dissolves in dilute nitric acid without effervescence, assuming a golden yellow color, and on evaporation a bright yellow residue is left.

(*h*) *Fibrin and Blood-clots.*—Concretions of this kind originate in renal hemorrhage. They are usually small, and the blood being partially decolorized, they have a reddish-brown, yellowish-brown, or dirty white color. They are sometimes soft, but generally firm, elastic, and tough, the consistence in some recorded specimens resembling that of beeswax. It must be remembered that the remains of a blood-clot may form the nucleus of other calculi.

(*i*) *Mixed.*—Calculi made up of different constituents are not uncommon, their characters being accordingly modified more or less. Thus the nucleus may be different from the body, for instance, a nucleus of oxalate of lime may be present in a uric acid stone, or, more rarely, the contrary is observed; again, the body may consist of alternate layers, more or less complete, of oxalate of lime and uric acid or urate of ammonia, such an arrangement forming what is termed an

[1] Urinary and Renal Diseases, 3d edition, p. 283 et seq.

[2] Pathological Transactions, vol. xx. p. 240.

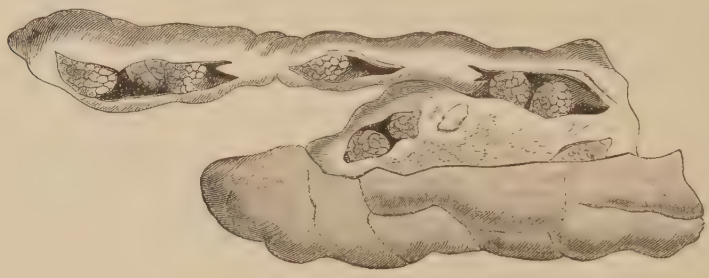
alternating calculus; and, lastly, any stone may be covered with a crust of phosphates.

3. *Direct effects on the Renal apparatus and neighboring structures.*—It is only practicable under this heading to indicate briefly the morbid conditions which renal calculi are liable to set up under different circumstances.

These concretions may be formed in both kidneys, and they may be of a different nature on the two sides. It has been affirmed that the left organ is more frequently affected than the right. The direct lesions induced by stone are usually only observed on one side, the opposite kidney being, however, frequently affected indirectly. It must be remarked at the outset that in many instances a calculus does not produce any notable effect upon the renal structures, either because it escapes along the ureter into the bladder soon after its formation, or because it becomes more or less encapsuled or encysted; and thus is rendered incapable of producing further mischief. The consequences of renal calculi depend upon their number, situation, size, shape, superficial characters as to smoothness or roughness, density, the time they remain in any part, and other circumstances. In general terms the lesions induced may be said to be the result either of obstruction to the escape of urine or of morbid products from the kidney; owing to the lodgment of a stone in the excretory passages; of mechanical injury; or of irritation setting up some form of inflammation. They may be most conveniently described according to the several parts of the renal apparatus which the concretions directly implicate.

(*a*) *Kidney.*—It may be mentioned that deposits are not uncommonly found in the renal tubules, consisting of similar substances to those which enter into the composition of certain calculi, and especially urates, and these are liable to set up chronic changes in the kidney, so that the organ becomes granular, contracted,

[Fig. 98.



Calculi of kidney and ureter.]

and indurated, a condition typically illustrated by the "gouty kidney." If one or more calculi remain in the substance of the organ, they cause more or less irritation, and this may lead either to congestion and hemorrhage, to the development of a surrounding fibrous cyst, or to the formation of one or more abscesses, which may burst into the renal pelvis and be discharged by the ureter, or may open in some other direction. In exceptional instances the renal tissue becomes actually gangrenous. The kidney becomes often seriously affected, as the result of the impaction of a stone in its pelvis or ureter.

(*b*) *Infundibulum and Pelvis.*—It is a common occurrence for one or more stones to lodge, either for a time or permanently, in this portion of the renal apparatus. They are liable to injure the mucous lining, causing more or less laceration, with consequent hemorrhage, and the discharge of urine mixed with blood. This effect is particularly liable to happen when a calculus is disturbed by walking, running, riding on horseback, or other modes of exercise, and it may only occur from time to time. As in the substance of the kidney, so in its pelvis, a stone may become more or less surrounded by a fibrous pouch, and be thus rendered innocuous, as in a case already alluded to, recorded by Dr. Church in vol. xx. of Pathological Transactions.

In rare instances a calculus which remains in the renal pelvis goes on enlarging until it completely fills this space, and occasionally even the infundibulum and calices. Hence the urine which is formed is dammed up, and cannot escape. A portion of it is reabsorbed, but the remainder gradually accumulates behind the calculus, giving rise to the condition termed *hydronephrosis*. By degrees the renal tissue becomes atrophied in consequence of the pressure exerted upon it, its papillæ first becoming flattened, and ultimately nothing may be left but a fibrous sac containing altered urine, with perhaps a trace of kidney-structure on its walls, and showing partial partitions in its interior with spaces between, corre-

sponding to the dilated calices. The obstruction may be subsequently removed, so that the fluid escapes, and the sac then shrivels up to a very small size. By far the most frequent result of calculus retained in connection with the kidney is the development of *pyelitis*. This condition is indicated at first by injection of the membrane, which may become of a deep red color, and numerous minute extravasations of blood are sometimes visible. The epithelium is shed more or less abundantly, and is discharged with the urine. Later on a muco-purulent or actually purulent fluid is formed, of a whitish or yellowish color, and more or less turbid and thick. It may be seen bathing the surface of the lining membrane, and often covering the calculus, or mixed with urine, stones, or their *débris*, or calcareous matters may be precipitated; at this time the membrane becomes paler, and is variously discolored. Occasionally a fibrinous deposit is observed on its surface, or it may be ulcerated or even gangrenous. Should the escape of the inflammatory products be prevented by the impaction of a calculus, they accumulate and distend the pelvis and infundibulum, constituting the condition termed *pyonephrosis*. If the obstruction is permanent, the kidney becomes involved and undergoes a purulent degeneration—*pyelo-nephritis*—ultimately becoming completely disorganized, merely a sac remaining, containing pus or calculi or their *débris*. This may attain considerable size, and frequently form extensive adhesions, while its walls consist of the thickened capsule of the kidney with some remnants of renal tissue, and its cavity may be more or less sacculated. Ultimately it may rupture in various directions, such as externally in the loins, into the colon or duodenum, into the peritoneum, or into the thoracic cavity. In some instances the obstruction to the escape of the fluid is only temporary, and it may occur from time to time, so that the sac fills up and is emptied at intervals.

[Fig. 99.

Dilated ureter and pelvis of kidney.]

(*c*) *Ureter.*—A calculus from the kidney frequently passes along the ureter to the bladder without doing any material damage. One serious event which may occur is that it becomes impacted, so as to obstruct the tube completely. This is followed by one or other of the consequences in connection with the kidney already described, but in exceptional cases it seems to lead merely to atrophy of this organ. The ureter above the seat of impaction generally becomes dilated and thickened, while below it may become narrowed. A stone may also lead to inflammation, ulceration, or even gangrene of this duct, and the subsequent cicatrization of an ulcer may close up its channel permanently. Lastly, the ureter may be much thinned at the seat of impaction, or actually ruptured.

(*d*) *Surrounding structures.*—The tissues immediately surrounding the kidney may become the seat of inflammation—*perinephritis*—terminating in the formation of pus. This may happen from the mere extension of irritation from the kidney, or as the result of the rupture of an accumulation of pus in the kidney or its pelvis into this part. Should an abscess form it may open in the various directions already indicated. Dr. Cayley[1] has recorded a case in which a calculus was discharged from an abscess in the right lumbar region, and subsequently two small calculi ulcerated out, one close to the crest of the ilium, one below the great trochanter.

4. *Remote effects and complications.*—Associated with renal calculus there may be various morbid conditions in other parts of the body, depending upon the presence of a gouty diathesis. If one kidney is destroyed or otherwise affected, so that it cannot perform its functions, the opposite organ tends to become hypertrophied, so

[1] Pathological Transactions, vol. xxvi. p. 128.

as to compensate for the loss of the secreting structure. An important result of renal stone, if it should cause the formation and discharge of much pus, is that it leads to the development of albuminoid disease, which affects the opposite kidney, as well as other abdominal organs or other structures. This condition may also cause septic poisoning, followed by pyæmic abscesses in various parts. The consequences of the rupture of a purulent collection in connection with the kidney will depend upon the direction which the pus takes, and in this way peritonitis, pleurisy, and other serious lesions may be set up.

Symptomatology. — The symptoms which may be anticipated in cases of renal calculus are referable to the following causes:—(1) Functional disorder of the kidneys; (2) mechanical irritation or injury set up by the stone; (3) the passage or attempted passage of a calculus along the ureter to the bladder; (4) the local pathological conditions which it may originate, especially calculous pyelitis and its consequences; (5) the general or constitutional disturbance, and the remote lesions which result from these pathological conditions.

The exact symptoms which may be thus originated, and the clinical progress of the disease, vary considerably in different cases, but in general terms the local phenomena may be summarized as pain or uneasiness in one or both renal regions; a tendency to frequent micturition in some cases; one or more attacks of renal colic; morbid conditions of the urine, including hæmaturia, the presence of epithelium-particles from the infundibulum and pelvis, of fragments of calculous matter, or of more or less pus; and the development of a renal tumor, due to the accumulation of fluid as the result of obstruction by a calculus, which may be permanent or only observed at intervals, frequently presents a sensation of elasticity or fluctuation, and is liable to open in various directions, the resulting symptoms differing accordingly. The general system also commonly suffers to a greater or less degree; and other organs besides the kidney may become involved as the result of complications.

Before considering the clinical history of calculous disease of the kidney in detail, attention must be drawn to certain important facts which relate to this subject. In the first place it is a matter of frequent observation that a renal concretion may remain in the kidney for an indefinite time without any indication or symptom of its presence,—indeed, there are many instances in which a calculus has been found lodged in the kidney, packed as it were securely in one of its calices or in a pouch, without any known indication of its existence throughout a long life. In the Westminster Hospital Museum there is a specimen illustrating this. Dr. Dickinson in the Pathological Transactions, vol. xxi. p. 255, has described a case of calculous pyelitis in which no symptoms of any distinctive character, or with any special reference to the renal organs, occurred till two years before the patient's death, and then only a sediment in the urine, like pus, but there was no disturbance of the general health, no pain or inconvenience, no frequency of micturition, nor had there even been pain or uneasiness referred to the course of the ureter. The left kidney had been converted into a large cyst, containing nearly a pint of purulent fluid. The cavity contained many minute concretions of oxalate of lime, not larger than poppy-seeds.

In other instances the symptoms are of a very obscure nature, there being, perhaps, only a little uneasiness or sense of aching over one lumbar region, either continuous or occurring from time to time, especially after effort, or a tendency to frequent micturition. It may happen that even serious morbid changes may be set up in the kidney insidiously, without the occurrence of any prominent symptoms to draw attention to the presence of calculous disease. Or, again, symptoms may be sufficiently characteristic for a time, but subsequently cease, owing to the stone becoming encapsuled, and thus being prevented from doing further mischief.

Again, observations have established the fact not only of the absence of all symptoms indicative of the existence of a calculus in the kidney, but even its escape and its descent down the ureter, its presence in the bladder, and its passage through the urethra, may all occur without pain or disturbance of any kind, except that during micturition a sense of some slight obstruction to the flow of urine is followed by the click of something solid falling into the chamber-vessel, and a small concretion of uric acid is seen, round and smooth. Such cases are not infrequent, and of some the writers have personal knowledge.

In other patients no symptoms of the formation of such a concretion or of its presence, no disturbance or alteration in the characters of the urine, to lead to the suspicion of such a disease, are manifested, till a sudden attack of renal colic occurs, or this may come on in cases in which a calculus is known to be present in the kidney, or the patient may even be subject to attacks at intervals. The colic is due to the entrance of the stone into the ureter, and, if this passes along to the bladder, the symptoms become aggravated

during its progress, but it must be remembered that the calculus may only attempt to escape, afterwards returning to the pelvis of the kidney. They are mainly due to the retention of urine behind the obstruction, with consequent dilatation of the passages; and to the spasmodic peristaltic action excited in the walls of the ureter, with the object of expelling the stone. The attack may set in quite spontaneously, even when the patient is asleep in bed; or it may depend upon some bodily exertion or jolt. It is characterized as follows:—Intense pain is felt in one lumbar region, often of a sharp, cutting, or pricking character, speedily becoming most excruciating, and accompanied with a severe griping colic-like paroxysm over the abdomen. The pain shoots in various directions,—downwards along the ureter to the hypogastrium, across the abdomen, along the crest of the ilium, directly backwards, or upwards towards the chest. Pain is also frequently felt at the end of the penis, along the inside of the thigh, and in the testicle on the same side, this organ being also retracted, and in course of time becoming in many cases tender and swollen. The leg may feel more or less numb. Accompanying these sensations there is usually a constant desire to micturate, along with strangury, only a very small quantity of urine being passed, drop by drop, which causes much burning pain along the urethra, and which is usually high-colored, often containing more or less blood, mucus, or pus. The urine may, however, be quite natural in appearance and clear, if the ureter is completely blocked up, and the excretion comes from the healthy kidney. Gastric symptoms are frequently prominent, and may be very distressing, namely, nausea, retching, or vomiting, which may be bilious. The patient is of necessity in much distress, and while very restless and anxious, dreads to move, and lies doubled up with the thighs flexed, or presses upon the affected side. In most cases there is more or less general depression, and often the patient becomes utterly helpless and prostrate, while signs of collapse appear, with a feeling of faintness, coldness of the surface, clammy sweats, and a rapid, small, and very feeble pulse. In some cases actual syncope occurs; or there may be general tremors, spasms of various muscles, or general convulsions. The respirations are frequently hurried. In prolonged cases more or less pyrexia is set up. Even death may result from the intensity of the suffering and its consequences. In pregnant women an attack of renal colic usually leads to abortion.

The severity of the symptoms just described varies in different cases, and remissions followed by exacerbations are observed during the passage of the calculus. A sudden subsidence of the paroxysm, preceded by a marked exacerbation, usually indicates the entrance of the stone into the bladder, accompanied with a sense of intense relief, and the patient may be conscious of something falling into the bladder. The time taken to accomplish the transit, and the consequent duration of the attack, also differs much, ranging from a few hours to days or weeks. Occasionally the paroxysm subsides gradually, in consequence of the stone crumbling down, and being discharged in fragments. In exceptional instances it becomes permanently impacted, leading to the development of hydronephrosis; or it may lead to ulceration and rupture of the ureter, followed by fatal peritonitis. As a rare event, complete suppression of urine occurs, followed by uræmic symptoms and death. This may happen either from calculi being passed on both sides simultaneously; from one kidney being diseased, and the stone escaping from the healthy organ; or in exceptional cases even when the obstruction is on one side, while the opposite kidney is perfectly healthy, and its ureter entirely free. When an individual is subject to repeated attacks of renal colic, they often diminish in severity, owing to the ureter becoming dilated.

When a calculus reaches the bladder, the subsequent course of events is again liable to vary. In favorable and not infrequent cases, the concretion escapes through the urethra with the urine. If of very small size, it may be expelled without difficulty, and almost without notice. In other instances an act of micturition is interrupted by a sudden stoppage of the stream, followed by straining, with anxious efforts to relieve the symptoms of retention, until a violent gush of urine projects the calculus from the urethra, and the sound of a solid substance falling into the vessel announces to the patient the spontaneous relief to his disease. In most cases, however, the stone remains in the bladder, increasing in size, and setting up cystitis or other lesions, unless it is got rid of by surgical interference.

The differences in the character and intensity of the symptoms of renal colic, and in the subsequent progress of events, clearly arise from the size, shape, external characters, and composition of the calculus. Thus a small concretion is more easily voided than a large one; and one of uric acid than one of equal size composed of oxalate of lime. If the urine can trickle down by the side of the stone, the symptoms will be less severe than if the ureter is completely blocked.

In another class of cases the first indication of renal disturbance is the passage

of a small quantity of blood or blood-stained urine, and this occurrence is chiefly associated with, apparently excited by, some bodily effort. A jump on horseback in the hunting-field, a jar or concussion in a carriage over a rough ground, or some such accidental occurrence, is followed by the appearance of blood in the urine; or the hæmaturia may occur without any such physical act.

The amount of blood passed is seldom considerable, although the urine may be blood-stained, and the microscope detect blood-corpuscles for several days afterwards. Sometimes the attack of hæmaturia is accompanied by lumbar uneasiness —a sense of aching in the loins rather than pain. There may be frequency of micturition, and pain at the neck of the bladder and extremity of the urethra, relieved by passing urine. The more typical symptoms of pain in and retraction of the testicle, numbness in the course of the external crural cutaneous nerve, or pain darting from the kidney through the ureter, may not be present at the early development of the renal symptoms.

Attacks of hæmaturia may occur every three or four weeks, the general health remaining unimpaired, but with obscure indications of renal irritation. In a case observed by one of the writers, hæmaturia occurring at intervals was the only symptom present for a long time.

The microscopic and chemical characters of the urine in these, at the outset, somewhat obscure cases, seem of the greatest diagnostic value. The urine will, during the presence of blood in it, be slightly albuminous, but the albumen disappears altogether when the hemorrhage has ceased, so that in the intervals, supposing them to extend to several weeks, the urine will be perfectly free from all trace of this ingredient. The sediment, when examined by the microscope, will be seen to consist of isolated blood-disks, and a few ordinary mucus-corpuscles; later, however, after several of these attacks of hæmaturia, the proportion of the mucus- or exudation-corpuscles will greatly increase, and it frequently happens that amorphous semi-crystalline masses will be seen, either free or buried in blood-clots, or occasionally surrounded by a group of exudation-cells.

Corresponding to these changes in the microscopic characters of the urine there will be observed subjective symptoms more especially typical of renal irritation, namely, more or less lumbar pain, with intervals of aggravation, extending down the ureter of the affected kidney to the neck of the bladder; uneasy aching sensations referred to the crest of the ilium, with numbness or altered sensibility in the cutaneous nerves of the thigh; a drawing-up of the testicles; and greatly increased irritation at the extremity of the urethra, leading in many cases, in both men and women, to a most distressing desire to pass water, but a scanty amount being discharged at each act. The urine now presents a great increase in the proportion of mucus, so that it falls to the bottom, instead of, as in healthy urine, half floating midway as a cloud.

The line of demarcation between calculous nephritis and calculous pyelitis is sufficiently marked in typical cases, but these are not so frequent as may be supposed; for in the majority of this class of renal disorders the first form passes by imperceptible degrees into the second, and for all practical purposes of treatment the two may be considered as the same. Pathologically, however, it is desirable to consider both forms as distinct, as the termination and ultimate results differ materially.

It may be stated that if to the symptoms of a paroxysm of nephralgia, there be added occasional attacks of hæmaturia, we have the typical indications of calculous nephritis. It must be remembered that in the intervals of these paroxysms, and after a lapse of a few days from the attack of hæmaturia, the urine returns to its ordinary healthy aspect, the only deviation from health being some divergence in the normal relative proportions of urea and uric acid.

A stone in the kidney, as has been already observed, may become permanently lodged in the seat of its origin, being surrounded by a capsule of areolar tissue, which screens the organ from further irritation, and also prevents any further addition to the growth of the calculus. This, however, rarely happens. Usually the stone is detached from its original seat, and a larger area of irritation is thus excited. Fresh material is added to its surface, and with this increased growth increased embarrassment in the urinary outlets occurs, giving rise to calculous pyelitis and its consequences. These changes are chiefly—it may be said solely—recognized by the altered qualities of the urine.

The progress of calculous pyelitis may be characterized by three groups or epochs of symptoms:—

1. Special alterations in the qualities and aspect of the urine.
2. The development of a renal tumor.
3. The formation and detection of a renal abscess.

It cannot be too forcibly observed, that the pathological changes which take place in calculous disease of the kidneys are various in degree and in the rapidity of their progress, as well as uncertain as to the final results; for it can never be definitely predicted in any given case what the duration or termination may be.

The clinical history of calculous pyelitis may conveniently be traced from the symptoms of calculous nephritis, which in the great majority of cases are the precusors of the more extended malady. With varying intervals in different patients, after experiencing attacks of nephralgia with occasional indications of hæmaturia, the frequency of micturition increases permanently—so that the irritability of the urinary passages, which in the early stage occurred in paroxysms as it were of a day or two at a time, now becomes constant, the patient having to rise many times during the night, and passing water every two or three hours during the day. The urine, if examined, is found to contain a much larger proportion of mucus than in health. This urine, when set at rest, instead of showing a delicate floating cloud, composed of a few epithelial cells, occupies perhaps one-third or even one-half of the glass—it is, however, still flocculent and not sedimentitious—and is composed entirely of what are called mucus or exudation-corpuscles or modified epithelium. The amount of these corpuscles is not yet sufficient to impart a cloudy appearance to the urine, until it has been allowed to settle in an appropriate glass. In a short time, however, they increase largely, so that the urine when passed is obviously cloudy, and appears just as ordinary urine would if a teaspoonful of milk had been added to it. This marks the first stage of the urinary change—the passing of a mucous urine into one more or less purulent.

The cause of these changes in the characters of the urine must be sought in the increased area and intensity of irritation which an increasing concretion is setting up. It is the irritation of a foreign body located in the urinary outlet.

The purulent character of the urinary sediment is marked by a most distressing frequency of micturition—often being most urgent—every hour or even every half hour, during both day and night.

Urine thus charged with purulent elements has a special proneness to undergo molecular change. At this stage urates are usually largely in excess, and become copiously deposited on the exterior of the calculus.

It is a clinical fact of some significance, that although the urine in the progress of this disease becomes more and more purulent, yet it uniformly maintains an acid reaction, and preserves its complete fluidity, separating when set at rest into two distinct portions — a well-defined sediment of pus-corpuscles; and a supernatant, clear, slightly acid, and slightly albuminous fluid urine. These conditions mark the limitation of the diseased action to the pelvis of the kidney. If the disease extends beyond the infundibulum and reaches the bladder, a very characteristic change in the quality of the urine takes place. The urine is passed ropy and ammoniacal, and deposits copiously crystals of triple phosphate. It is of much importance to decide how far, or if at all, the bladder has become implicated. This can only be determined by an examination of the urine immediately after micturition. For it may happen, according to the season of the year, the temperature of the air, or the number of hours after excretion, that a urine derived from a kidney the seat of a simple calculous pyelitis, will assume all the properties of a urine passing through a bladder the seat of disordered action. That which in a purulent urine, possessing when voided all the characters above enumerated as diagnostic of calculous pyelitis, will very shortly become by decomposition ammoniacal, ropy, and cloudy, and will exhibit numerous crystals of the triple phosphate.

If the urine be voided cloudy and turbid, with more or less viscidity, alkaline, and possibly ammoniacal, and if, instead of a well-marked pus sediment, there be a jelly-like magma; if the antecedent history of the case be that of calculous nephritis, then it may be confidently inferred that the original disease has become calculous pyelitis, with extension of irritation to the bladder itself. The cause of this extended disease for the most part arises from small portions of the recently deposited layers of the renal concretion becoming detached, and while present in the bladder setting up an irritation which induces the changes in the urine just enumerated. Proof of this is frequently met with when the jelly-like magma is examined, either with the magnifying glass or with the microscope; there is seen entangled in the mass amorphous matter, chiefly urates, embedded in it. The gelatinous material in which the concreting matter is concealed is a mucus formed in the bladder in great excess, owing to the irritation of the material derived from the renal calculus. In these cases so abundant oftentimes is this gelatinous material, that the chamber-pot becomes encrusted with a thick coating, which can be scraped off in masses, and when chemically examined it is found to consist chiefly of urates and uric acid grit.

It is at this stage that the possibility of these masses, or of granules of uric acid, becoming the nucleus of a vesical calculus, presents itself. Many of the symptoms at this stage point to this disease, and the examination of the bladder by a skilful surgeon becomes desirable.

The microscopic objects in these urines are exudation and mucus corpuscles, isolated or in groups. Large fields of them are often seen, surrounding fine granular matter, or amorphous concretions of uric

acid. Oval and pyriform cells from the pelvis of the kidney and ureters may in the earlier stage be also visible.

It is in such cases as these, when the disease having originated in the kidney has extended and eventually implicated the bladder, that the differential diagnosis between renal calculus and stone in the bladder becomes difficult, though important, and indeed can only be determined by a careful examination of the bladder in the usual way for stone.

Another class of cases will terminate in the formation of a renal tumor and renal abscess, the passage of the pus generated within the cavity of the kidney becoming obstructed by the growth of the calculus, which becomes branched and moulded into the hollows of the calices, or impacted in the infundibulum, while it increases by the accretion of urates and triple phosphates, and eventually so blocks the outlet into the ureter as to retain both urine and pus within the diseased organ. The recognition of this stage of the disease is not difficult. The chief and most prominent feature is the varying aspect and condition of the urine. The impaction of a calculus in the cavity of the infundibulum causes, as has been already shown, an accumulation of the urine secreted by the kidney, and of the pus generated by the diseased structures behind the obstacle; a dilating force is thus created, which leads to the dilatation, sacculation, and eventually to the complete atrophy and obliteration of all secreting tissue. At first, however, the retention of the fluid is not complete. The calculus does not completely fill or obstruct the outlet; the dilating force of the accumulating fluids suffices to expand the infundibulum sufficiently to permit a portion of them to pass down the ureter into the bladder. This stage of the disease is marked therefore by the fluctuating character of the urine, and by certain periodical exacerbations of the patient's sufferings.

The order of these occurrences is very much as follows: A certain sense of uneasiness, fulness, or aching is perceived in the lumbar region on the side affected. The urine is noticed to become daily less milky or impregnated with pus; it gradually acquires an ordinary appearance, and the patient would flatter himself that his complaint was slowly disappearing, but that the pain and aching in the back augments almost in proportion to the apparent improvement in the urine. A careful examination of the region of the kidney demonstrates the presence of a renal tumor, which affords more or less evidence of elasticity or fluctuation.

In these cases it must be supposed that one kidney is free from disease, so that while the secretion of the one is retained, the function of the other continues uninterrupted. It is not usual, and only happens in rare cases, that both kidneys are simultaneously affected with calculous disease. Museums, however, contain specimens of such, and the experience of physicians is cognizant of such cases. It is, however, only as the calculous disease advances, and has existed for many years, that the second kidney becomes implicated. One of the writers (Dr. Basham) has had the opportunity of studying and keeping under observation for twenty-two years this form of double renal calculus. The disease in the left kidney was determined at the age of fifty-seven by the formation of a renal tumor, and the subsequent excretion for some eight or nine years of a purulent urine. At the age of sixty-five, eight years after this calculous disease of the left kidney was diagnosed, a tumor in the right lumbar space, fluctuating, and by pressure imparting pain in the course of the ureter of that side, with subsequent diminution of the area of the tumor, and greatly increased amount of pus in the urine, pointed to the implication of the right kidney in a similar form of disease. The patient lived to the age of seventy-six, and a post-mortem examination demonstrated the all but complete destruction of both kidneys, which were crowded with sacculated pouches, the cortical part of either kidney not exceeding in thickness the rind of an orange, and both infundibula being filled with accumulations of concretive matter composed of triple phosphates and urates, with central layers of uric acid and oxalate of lime. The ureters for some half-inch down were packed with this calculous *débris*.

As the renal tumor increases there is often a great amount of gastric disturbance, in the form of nausea, retching at times, and great inappetency, with absence of sleep; and these conditions frequently alternate remarkably with the retention of the fluids within the renal abscess. As this increases these constitutional symptoms increase also; but as soon as the outlet for the escape of pus and urine has been again established, the disturbance ceases, and the patient returns to a state of comparative ease and health. It may, therefore, in these cases be confidently expected that so long as the urine is purulent (but not ropy), there is a comparative exemption from suffering; but when it clears and presents little to notice, the patient's sufferings return.

Sex appears to exercise a modifying influence, as women endure this disease much longer, suffer less distress, and escape many of the severe complications which present themselves in men. The bladder less frequently participates in the diseased state of the urethra; this probably arises from the freer passage through

the urethra of calculous particles or concretions in women than in men, and the former sex also escape the distress, trouble, and suffering occasioned by the presence of prostatic disturbance.

The general system suffers more or less during the progress of the symptoms above described, as indicated by pyrexia, wasting, weakness, loss of appetite, and other phenomena. The course of the symptoms towards a fatal termination in cases of calculous pyelitis varies much in different constitutions. In some the appetite, as well as the digestive and assimilative functions, slowly fail, a distaste for food of any kind exists, and a low adynamic fever is the result, with a quick and feeble pulse, a brown dry tongue, the skin being dry, but not much elevated in temperature, the stomach often becoming irritable and rejecting all ingesta, and thus the patient slowly sinks, and eventually dies from asthenia. Some cases are complicated with symptoms of uræmic poisoning; and in others, particularly those whose bladder complication has for some time pre-existed, with ropy muco-purulent turbid urine, the termination of the case is marked by symptoms of some form of capillary embolism, developed by a purulent-infected blood, the locality of this complication being uncertain and variable. These low forms of what at first appears like erysipelatous inflammation may involve one leg or foot, with extension of the swelling and hardness up to the groin—symptoms beginning with indications only of capillary obstruction, but terminating with evidence of fibrinous exudation in the sheaths of the large vessels of the thigh. In other instances the evidence of the pus-poisoned blood rests on the development of pulmonary symptoms, dyspnœa, and exhaustion. In all, however, whatever form of complication may be developed, the same defective assimilative power, inappetency and rejection of food, with a weak, small, but frequent pulse, a dry tongue, and gradual exhaustion, invariably mark the termination of the case.

Various symptoms may arise during the progress of calculous disease of the kidney, from the rupture in different directions of a hydro-nephrosis, of a purulent collection in the kidney, or of a perinephritic abscess. Thus a collection of pus may make its way to the surface, either in the lumbar region or elsewhere, finally opening or being artificially opened, and then perhaps discharging calculi or their remains, as in the case previously mentioned which is recorded by Dr. Cayley. After such a termination recovery usually follows. Or the rupture may take place into the peritoneum, with the usual symptoms of such an event, followed by those of peritonitis. Again, the fluid may find its way into either the ascending or descending colon, according to the side affected, this event being indicated by a sudden severe attack of diarrhœa, the discharged matters being mixed with pus, and the simultaneous subsidence of the enlargement. On the right side it has in rare instances communicated with the gall-bladder and duodenum. This communication with the intestine may terminate in recovery, but it is not nearly so favorable as the external opening. In exceptional cases the accumulation of pus penetrates through the diaphragm into the pleura, setting up the clinical signs of pleurisy; or it may open into the lung, and thus into the bronchi, being afterwards expectorated.

Lastly, it must be remembered that complications may be associated with renal calculus, either as more or less remote consequences, or as coexisting conditions; and they give rise to their several clinical phenomena. Thus, there may be symptoms of gout; or evidences of albuminoid disease of the healthy kidney and other organs may be developed; or unquestionably pulmonary phthisis may be set up as a result of chronic suppuration. Biliary calculi are sometimes associated with renal calculi, and one of the writers had a case recently under his care, in which the patient passed first a large gall-stone, and afterwards a renal calculus, consisting probably of uric acid.

Diagnosis.—There are several points relating to the diagnosis of calculous disease of the kidney which it will be necessary to consider.

The first matter to be determined is the presence of one or more calculi in some part of the renal apparatus. This may be clearly indicated by the local sensations, combined with hæmaturia, or with other morbid characters afforded by the urine, evidencing the existence of calculous pyelitis. In doubtful cases, which are not uncommon, where the symptoms are obscure, very careful examination of the urine is demanded, for the detection of traces of blood, or of epithelium detached from the pelvis and infundibulum of the kidney; and it will be well to carry this out after the patient has made some effort. It must be remembered, also, that renal calculus may be clinically latent, and then it will be impossible to recognize this disease. Repeated hæmaturia, provided that the blood can be shown to come from the kidney and endemic causes can be excluded, will probably be due to renal calculus, even though there be no other symptoms of the disease.

Supposing that the diagnosis of calculous disease of the kidney has been established, it will in the next place be desirable to determine the nature of the stone,

as this may have a material influence as regards the treatment. In many cases there are no adequate data for forming any definite and satisfactory conclusion on this matter, and at the best the diagnosis must usually be doubtful. It is founded upon the known relative frequency of different kinds of calculi; the constitutional condition, as affording evidence, for instance, of a tendency to the excessive formation of uric acid or urates; and upon the composition of the urine, or the presence in this fluid of gravel, of fragments of calculous matter, or of different crystalline deposits, as these elements will probably correspond to the constituent which forms the calculus.

The next point, which is of considerable importance, is the diagnosis of renal colic, due to the passage of a stone along the ureter. In a considerable proportion of cases this is perfectly easy, the symptoms already described being highly characteristic. Of course when there are no symptoms, in consequence of the small size of the calculus, its escape cannot be recognized. It must also be borne in mind that other objects may traverse the ureter besides a calculus, such as a blood-clot or a hydatid vesicle, and the symptoms characteristic of renal colic would then be observed to a greater or less degree. They may also be simulated by neighboring affections, especially spasm of the lumbar muscles, severe neuralgia of the intercostal or lumbar nerves, spasm of the colon, and the passage of a gall-stone. In these conditions the urine is not altered. In the complaint last mentioned, the pain is on the right side, and is higher up in the hypochondriac region as well as more towards the front than in renal colic, while it is usually associated with, or followed by jaundice and other symptoms which accompany hepatic colic. Among the curiosities of medical literature, cases are described in which a communication has been established between the gall-bladder and the ureter, and hepatic calculi have consequently escaped into the urinary bladder. This course of events would generally be recognized by the presence of a large quantity of bile in the urine, apart from jaundice; and by the composition of the concretions.

Should the stone escape either into the bladder or through the urethra, it will necessarily be a matter of much moment to determine whether this is the only concretion, or whether one or more remain behind in the kidney. This question is often very difficult to decide, but much assistance may be derived from the composition of the calculus, and from observing if the local symptoms subside after it has descended, and if the urine returns to its normal characters. Should this course of events not happen, the probability will be that irritation is still kept up by remaining concretions, either in the same or the opposite kidney, of which the number cannot be determined. This is not always the case, however, for a calculus may produce lesions which are permanent, although the primary source of irritation is removed. It has been affirmed that when a number of concretions collect in the renal pelvis, it may be possible by manipulation to bring out a sound due to their being rubbed against each other.

It is always a matter of great consequence to make out whether calculous disease is confined to one kidney, or implicates both organs. The seat of the local sensations is of course mainly to be relied on for settling this point, these sensations being referred to the side affected. Assistance may also be derived from the nature of any concretion which has been passed. Thus a phosphatic stone is almost always unilateral, while uric acid calculi are not uncommonly found in both kidneys. In certain cases important information is derived from the characters of the urine. Should this fluid have been purulent, owing to calculous pyelitis, and should it become healthy and perfectly free from pus during an attack of renal colic, or in association with the formation of a tumor in one renal region, due to the blocking-up of the corresponding ureter, the great probability is that the opposite kidney is free from disease.

The diagnosis of the more prominent pathological effects produced by a stone in and around the kidney from other conditions is usually not difficult. Pyelitis is recognized by the characters of the urine; and any accumulation of fluid is followed by the development of an enlargement in the renal region, which presents a sensation of more or less elasticity or fluctuation. The alternation of purulent urine with a renal tumor presenting this character, as described under the symptomatology, is highly characteristic of calculous disease. The diagnosis of the exact cause of any local enlargement associated with this complaint is often a matter of much difficulty, but for practical purposes it may not be of much moment. The aspirateur may prove of much value in determining the nature of any fluid accumulation. The opening of such an accumulation in various directions must be judged of by the special symptoms which would then arise.

The last point which has to be noticed is the diagnosis of calculous disease of the kidney from other affections. In the first place this complaint has to be distinguished from neighboring affections, especially lumbago and other painful maladies. Any persistent pain in either loin should be taken due notice of, and not merely referred, without proper investi-

gation, to the muscles and fasciæ. The conditions likely to be mistaken for renal colic have already been pointed out. Then, again, calculous disease may be confounded with other renal affections, or with those of the ureter. It may be very difficult to distinguish it from mere gravel, which is liable to give rise to similar symptoms, though of a milder type usually. Cancer, hydatid disease, and other morbid conditions of the kidney may also be mistaken for calculus, especially as they may originate hemorrhage, and the passage of blood-clots or hydatid-vesicles may simulate that of a stone. It must be borne in mind that calculous disease may exist along with these conditions. Pyelitis from tubercular disease or other causes may resemble that due to stone. Lastly, the relation of the kidney to the bladder is highly important. When a calculus is localized in the kidney, the symptoms occasionally seem to be referred to the bladder, even though this organ is quite healthy. Moreover, a stone or portions of it may pass into the bladder, and subsequently set up cystitis. This is usually indicated by the supervention of vesical symptoms, and particularly by the changes in the characters of the urine, which becomes ammoniacal, alkaline in reaction, and ropy. In some instances renal disease follows the vesical affection, but under such circumstances the characteristic symptoms of the latter have usually been sufficiently obvious in the early stages.

Prognosis.—Calculous disease of the kidney must always be regarded as a serious affection, and great caution should be exercised in forming an opinion as to how it may terminate in any particular case, or what may be the course of events. The progress is usually essentially chronic, and when death occurs, in the great majority of cases it takes place more or less gradually, as the result of direct or remote lesions induced by the calculus. In exceptional cases the fatal termination is rapid, in consequence of the bursting of a purulent accumulation, rupture of the ureter during the passage of a stone, uræmia from the blocking-up of this tube, pyæmia from purulent absorption, or other causes. The prognosis as to the cure of the complaint is worse in proportion to the time a calculus has remained in the kidney; to the extent of the lesions which have been set up; and to the presence of a constitutional condition, whether hereditary or acquired, favorable to calculous disease. It is also more unfavorable if the calculi are multiple, or if both kidneys are affected. On the other hand, recovery may be hoped for when the disease is recent, and comes under treatment at an early period; when it is of a local origin; when the stone passes into the bladder, and there is no evidence that any more concretions remain in the kidney; and when the disease seems to be limited to one side. Even after extensive lesions have been set up, provided they are confined to one kidney, recovery may ensue, the involved organ becoming shrivelled up and useless, while the opposite one enlarges and assumes a compensatory activity. This may occur after the opening of purulent accumulations externally, or even into the intestines. It must not be forgotten that the renal calculus may be got rid of for the time, while a tendency to the recurrence of the complaint remains, and a fresh concretion may form if this tendency is not removed.

Treatment.—The management of cases of renal calculus must be regulated in different cases according to the actual conditions present. There are, however, certain general principles or indications upon which the treatment has to be conducted, and these it will now be requisite to discuss.

1. *Preventive Treatment.*—It may happen that the chief aim of treatment should be to prevent the development of calculous disease under circumstances in which this complaint is liable to arise. This applies mainly to calculi of uric acid or urates, but the principle may also be recognized in connection with some other varieties. The chief circumstances under which this preventive treatment is indicated are when there is a marked hereditary tendency to the disease, or the gouty condition is prominent, whether hereditary or acquired; when there is a history of calculi having been passed or removed on former occasions; when the urine presents certain abnormal characters, namely, that this fluid is persistently alkaline or ammoniacal, contains gravel of uric acid or oxalate of lime when first passed, or deposits crystals of either of these elements soon after its discharge and before it has had time to cool, or reveals the presence of cystine; and when there are signs of the existence of any renal disease which is liable to be followed by the formation of calculi. The preventive treatment must also keep in view the limitation of the further growth of a stone, or of the development of additional concretions.

In order to carry out this indication, general management is of the greatest importance in most cases, having reference especially to the diet and habits of life. The measures to be adopted are mainly those which have already been considered in describing the treatment of lithiasis and lithæmia. The diet must be duly regulated, being of a simple kind, while the amount of nitrogenized food, and especially of meat, must be particu-

larly moderated. In some cases, indeed, it is desirable to forbid meat altogether, either permanently or from time to time; but this is by no means required as a rule, and a fair quantity may be allowed to those who take adequate exercise, and who lead an active life. Rich and indigestible kinds of food must be avoided, as well as all highly-seasoned dishes. It is very important that there should not be too long intervals between the taking of food, and also that large and heavy meals should not be indulged in: therefore the patient ought to have four or five light meals a day. When there appears to be any tendency to oxalate of lime calculus, vegetable substances which contain abundance of oxalates must be avoided, especially rhubarb and sorrel.

The question of drink has also an important bearing in the prevention of calculus. In the first place good water should be taken freely, and it is especially recommended, for certain physiological reasons, that a tumblerful be taken the last thing at night, and also about two hours before dinner. By this means a free and abundant flow of urine is maintained, the urinary ingredients are kept in solution, and any deposits formed in the kidney are likely to be washed away. Waters containing much lime had best be avoided. The effervescent waters—soda-water, potass-water, lithia-water, or seltzer-water—are also useful in moderation. With regard to stimulants, great care must be exercised in their employment. In many cases they had better be avoided altogether, and all strong or heavy wines must be rigidly forbidden. In some instances a little well-diluted whiskey or gin may be of use, by acting as a diuretic, or good claret may be taken with advantage.

In addition to these measures, it is usually necessary for any one who is prone to calculous disease to take more or less active exercise, and to avoid a sedentary life; to maintain a healthy action of the skin by means of baths, followed by friction; and to wear warm clothing with flannel next the skin. It is also desirable that the hours of rest in bed should be curtailed, as the recumbent posture seems to be favorable to the development of calculous disease, and therefore early rising should be practised.

Medicinal treatment is often of much service for the prevention of renal calculus. In the first place the functions of the digestive organs must be maintained in good order, the bowels kept well opened, and the secretions free. For these purposes alkalies or dilute mineral acids with some bitter infusion or tincture may be of service, with an occasional dose of blue-pill and rhubarb pill, as well as aperient mineral waters, especially the Hunyadi Janos or the Friederichshall water, taken the first thing in the morning, as frequently as may be required. Diuretics have been employed for the purpose of creating an abundant flow of watery urine, and thus dissolving or washing away any sediments which may have formed in any part of the kidneys. All powerful remedies of this class, however, ought certainly to be avoided, for they tend to irritate the urinary organs. The most important medicinal agents employed for the prevention of calculous disease are those which dissolve certain materials which tend to form concretions, and thus to prevent their deposition; or even dissolve them after they have been precipitated in the form of gravel. For deposits of uric acid, urates, and oxalates, certain alkaline salts are highly efficacious. Different salts of this class are recommended by different authorities, especially bicarbonate or phosphate of soda, bicarbonate or citrate of potash, and carbonate of lithia. It seems not improbable that these might severally be suitable for different cases, but in the writer's experience citrate of potash, in drachm doses twice daily, well diluted, has proved generally serviceable. Certain mineral waters which contain alkaline salts are also of great value, such as those of Carlsbad, Vichy, Saltzbrunn, &c., some of which are useful at the same time on account of their aperient action. They must, however, be employed under proper supervision.

For the prevention of phosphatic deposits and those of carbonate of lime, certain acids are indicated, namely, carbonic acid water, and solutions of vegetable acids, such as citric, malic, or acetic, which in their passage through the system become converted into carbonic acid, and thus the urine is maintained in an acid condition. If the formation of secondary phosphates should result from retention and decomposition of urine in the renal pelvis, all that can be done is to try to promote a free flow of the excretion in an acid state, which might both wash out the space and neutralize the ammoniacal condition.

2. *Treatment to aid the solution or escape of a Renal Calculus.*—Bearing in mind the pathological consequences which may arise from calculous disease of the kidney, it is reasonable to conclude that as soon as there is evidence of its existence, the first object aimed at in treatment should be to get rid as soon as possible of any concretions and thus prevent further mischief. For this purpose attempts have long been made to dissolve renal calculi through the agency of medicines, which, by affecting the composition of the urine, might act chemically upon these concretions. This mode of treatment was, how-

ever, founded on a very unsatisfactory basis, until Dr. William Roberts,[1] by experiment and clinical observation, endeavored to establish it upon a scientific and practical foundation. So far as renal calculi are concerned, it is probably only concretions of uric acid or urates which can be affected in this way, and these may be acted upon by alkalies under certain conditions. Dr. Roberts advocates this method of treatment when the urine is acid, and when the calculus is either known to consist of uric acid, or even when its nature is doubtful, as it does no harm should the stone be made up of oxalate of lime. He points out that the action of the alkalized urine must be continuous and incessant, and that a certain degree of alkalinity must be kept up. He prefers salts of potash, especially the acetate, in doses, for an adult of forty to sixty grains, for children twenty to thirty grains dissolved in three or four ounces of water; or the citrate, prepared according to the following prescription: ℞. Potassæ bicarb. ʒxij; Acidi citric. ʒviij, gr. xxiv; Aquæ ad ℥xij. Of this solution the dose for an adult is six or eight fluidrachms, for a child three to six fluidrachms, mixed with three or four ounces of water. The dose should be repeated at intervals of not less than three hours, and it should be given with rigorous regularity during the waking hours. A dose should be taken the last thing before retiring to rest, and another in the course of the night, should the patient waken. Dr. Roberts urges the importance of frequently examining the *freshly-voided* urine when this plan of treatment is being carried out, and affirms that when this excretion is sweet, and has not undergone ammoniacal decomposition when first passed, there is no fear of the deposition of mixed phosphates upon the calculus, which has been one of the arguments against this mode of treatment. Should the urine become ammoniacal, the treatment must be suspended. Otherwise it may be carried on for months without doing any harm, and if the acetate or citrate is employed, the digestive functions are not at all impaired. The writer has recently had under observation a case in which there was strong evidence of the existence of a renal calculus composed of urates, and which seemed to be much benefited by this plan of treatment. Even if the calculus is not entirely dissolved, it may be diminished in size or broken up, and thus be enabled to escape by the ureter. The solvent treatment has also been attempted in cases of supposed fibrinous concretions. [Koehler,[1] of Kosten, affirms the solvent power of *borocitrate of magnesium* for uric acid calculi. This salt is obtained by dissolving boracite (natural borate of magnesium) in citric acid. Its dose is a large teaspoonful in half a tumblerful of water, thrice daily. —H.]

Apart from the solvent treatment, there does not seem to be any plan open for aiding the escape of a calculus so long as it remains in the renal pelvis. If it should enter, or show a disposition to enter, the ureter, it appears advisable to encourage its passage downwards along this duct, even with its attendant suffering and possible consequences, rather than to try to cause the stone to return to its former seat. The late Sir James Simpson on two occasions practised successfully the plan of inverting the patient, so that the head was directed downwards, and then manipulating with the view of making the calculus fall back into the renal pelvis.

Such treatment, however, seems only called for when the symptoms are very urgent and the concretion shows no disposition to descend. The descent of a calculus which is lodged in the ureter may sometimes be aided by careful manipulation and pressure in a downward direction, in the course of this tube.

When a calculus cannot be treated by solvents, and is too large to escape by the ureter, it has been suggested to keep the patient perfectly at rest in the recumbent posture for a prolonged period, in the hope that the concretion might form a pouch around it, and thus be rendered innocuous. In some cases certainly benefit might be anticipated from this plan.

3. *Treatment of Renal Colic.*—The symptoms which arise during the escape of a stone from the kidney to the bladder demand measures for their relief, and some of these measures will also assist in accelerating its descent. The patient should be kept as quiet as possible, and great benefit is often obtained from the employment of prolonged warm baths. The only reliable medicinal agents are narcotics and anodynes. Of these opium and morphia are the most important. The former may be given by the mouth in the form of the tincture or the liquor opii sedativus, in full and repeated doses, until the patient is brought well under its influence. In some cases, in consequence of sickness, it cannot be taken by the mouth, and may then be administered in starch enemata. Subcutaneous injection of morphia is most valuable in many cases. Belladonna and chloral are also useful remedies, and the latter has been successfully employed in combination with morphia.

[1] See Medico-Chirurgical Transactions, 1865; and Urinary and Renal Diseases, 3d edit. p. 299 et seq.

[1] Berliner Wochenschrift, Nov. 3, 1879.]

If the attack of renal colic is prolonged, the careful inhalation of chloroform from time to time may be resorted to. The use of watery diuretics has been advocated, with the view of creating a free flow of urine, and thus helping to drive on the calculus by the pressure of the fluid, but such a plan of treatment seems to be attended with considerable danger. Local applications may be of service, such as the assiduous employment of hot fomentations, or the application of large warm poultices; to these anodynes might be added. Local removal of blood, by means of cupping, may be demanded in some instances, and in highly sthenic cases even general venesection might possibly be indicated.

4. *Treatment of Symptoms and Complications.*—The immediate pathological consequences of renal calculus not uncommonly demand attention, namely, hemorrhage, with consequent hæmaturia, which must be treated by rest and the administration of astringents. Hydronephrosis, pyelitis, and purulent accumulations, either within or around the kidney, must be managed on the same principles as when they arise from other causes, which are discussed under the several articles. Their remote effects may also require different modifications of treatment, such as that directed to peritonitis, pleurisy, albuminoid disease, &c. General treatment is also indicated frequently in the way of a supporting diet, stimulants, tonics, cod-liver oil, or other therapeutic agents.

5. *Operative Treatment.*—This may be required for the removal of an accumulation of fluid associated with calculous disease. Two special operations have been resorted to in some instances, namely, nephrotomy, and extirpation of the kidney. The former consists in making an incision into the kidney from the loin, and then extracting any calculi which can be discovered on examination. This operation is only admissible when an accumulation of pus has pointed externally, and it has become necessary to open this. Extirpation of the kidney has been practised for various conditions, and in a few instances with success. This operation has been advocated in certain cases of calculous disease, but few would venture upon such an heroic measure.

HYDRONEPHROSIS.

By Frederick T. Roberts, M.D., B.Sc., F.R.C.P.

Definition.—Hydronephrosis (ὑδωρ, water, and νεφρον, a kidney) is the condition characterized by accumulation of urine within the pelvis of the kidney, due to some impediment interfering more or less with its escape. This leads to dilatation of the renal pelvis, infundibulum, and calices, with subsequent atrophy of the kidney-structure. The obstruction may be situated in any part of the urinary passages, from the upper opening of the ureter to the orifice of the urethra, and consequently the distension may be confined to the kidney, or may also involve more or less of the ureter, the bladder, or even the canal of the urethra.

Synonyms.—Hydrops renalis; Dropsy of the kidney; Hydrorenal distension; Hernia renalis; Hydronephron.

Etiology.—In a few exceptional cases of hydronephrosis which have been recorded, no cause of obstruction to the escape of the urine could be detected, but this was probably due either to its having existed at a previous period and been removed; or to its having been overlooked at the post-mortem examination. In the great majority of instances the impediment can be satisfactorily made out, and the numerous conditions which have been found to originate hydronephrosis are conveniently arranged under the two groups: 1. Congenital. 2. Acquired.

1. *Congenital.*—A considerable proportion of cases of hydronephrosis belongs to this class. Out of fifty-two cases collected by Dr. William Roberts, twenty were congenital, thirteen of these being double.

When this condition exists at birth, it is often associated with various congenital malformations. Congenital hydronephrosis usually depends upon some abnormal state of the ureter. This tube may be greatly narrowed or even completely occluded in some part of its course, or at its entrance into the bladder. In other cases it has been found to communicate with the renal pelvis at a very acute angle,

forming a valve-like arrangement, which prevents the escape of the urine, the difficulty being increased as this fluid accumulates in the pelvis. In very rare cases, as has been mentioned in a previous article, anatomical peculiarities affecting the renal artery may originate hydronephrosis, this vessel taking an abnormal course, or there being an additional artery, and in either case the ureter may be pressed upon, or the vessel may twist round it. Another congenital cause of hydronephrosis is closure of the canal of the urethra, which leads to dilatation of the bladder, as well as of both ureters and pelves of the kidneys.

2. *Acquired.*—Several important causes of hydronephrosis come under this category, and they may be thus arranged: (*a*) Obstruction of the ureter or renal pelvis by the lodgment of a calculus or other mechanical obstacle, which blocks up the passage. (*b*) Disease of the walls of the ureter, leading to the contraction and ultimate closure of its channel. This may result from inflammation, ulceration with subsequent cicatrization, or carcinoma involving the walls of the ureter. (*c*) Disease of the bladder in the vicinity of the orifice of the ureter, closing up its outlet. An abscess of the walls of the bladder, and malignant disease, have been known to produce this effect. (*d*) Conditions affecting the ureter from without, either compressing it, dragging it out of its course and fixing it there, or bending it, and thus interfering with its channel. This class of causes is much more frequent in females than in males, and includes chiefly inflammation of the pelvic cellular tissue; peritoneal inflammation, originating thickened bands; retroflexion or prolapse of the womb; a pregnant uterus; cancer of this organ; and ovarian or other pelvic tumors.

Anatomical Characters.—Hydronephrosis consists essentially in the gradual accumulation of the urinary excretion within the renal pelvis, this fluid in time becoming more or less altered in its characters; and of certain pathological consequences resulting from this accumulation. In the majority of cases the condition is unilateral, especially if it becomes extreme, but it is not uncommonly double, though both kidneys are not usually affected to an equal degree. Out of fifty-two cases collected by Dr. William Roberts,[1] thirty-two were single (nineteen right and thirteen left), and twenty double. The degree of distension varies greatly in different cases. Thus the sac has been found to range from a size not larger, or even less than the normal kidney, to an enormous dilated space containing as much as thirty gallons of fluid. At first this fluid connects in the renal pelvis, infundibulum, and calices, but as it increases in quantity, it not only causes distension, but also leads to gradual wasting and absorption of the renal structures. The medullary portion first becomes affected, the papillæ being flattened, dwindling down, and finally disappearing altogether. Afterwards the cortical substance becomes involved, and undergoes similar atrophy, until ultimately but little or no traces of it remain. Even in very large hydronephrotic sacs, however, it is common to find portions of renal tissue on the walls, in the form of detached reddish islets, in which urinary tubules and Malpighian bodies can be detected on microscopic examination. In extreme cases no trace of kidney-structure remains. The sac usually presents a more or less lobulated appearance externally, and on opening it fibrous septa are found, corresponding to the external depressions, and partially dividing it into sacculi or chambers, which correspond to the dilated calices, and which communicate freely with the renal pelvis, and thus with each other. In extreme cases these septa disappear, and the sac becomes quite uniform and undivided. When the renal tissue has been removed, the walls of a hydronephrotic sac are formed of the thickened capsule, and consist of tough and dense fibrous tissue, highly vascular, smooth internally, but more or less rough and uneven externally, owing to adhesions having formed with surrounding structures. Occasionally plates of a fibro-cartilaginous tissue are found imbedded in the walls.

The fluid which is found in cases of hydronephrosis almost always consists of urine more or less altered in its characters. It is very watery, of low specific gravity, often faintly alkaline in reaction, yellow in color, and either clear or somewhat turbid. It usually contains the ordinary urinary constituents in various proportions, but urea is often only present in small quantity, and may be entirely absent. Uric acid is also occasionally wanting. There may be crystals of oxalate of lime. Admixtures of blood, pus, or epithelium may be found, and thus the fluid may present a reddish, reddish-brown, or grayish-yellow color, as well as unusual turbidity. It is always more or less albuminous. In exceptional instances the contents of a hydronephrotic sac consist of a gelatinous colloid substance, as in a case reported by Dr. Dickinson;[1] of thick, fatty fluid; or of a caseous material.

Peculiarities are observed in exceptional

[1] On Urinary and Renal Diseases, 3d edit. p. 486.

[1] Pathological Transactions, vol. xiii. p. 137.

cases, the hydronephrosis being limited to a part of the kidney, or there being two ureters, one of which is obstructed. If the seat of obstruction is in the course of the ureter or at its opening into the bladder, the duct partakes in the enlargement, and is found to be more or less dilated, elongated, tortuous, and thickened in its walls, the muscular element of which may be hypertrophied. The tube has been observed as large as the small intestine. When the urethra is closed, the bladder is also involved.

The effects of hydronephrosis upon neighboring structures are to displace and compress them more or less, and these effects may be carried to an extreme degree, the abdominal walls becoming also stretched. The colon is usually situated in front of the sac, but occasionally is found on its inner or outer side.

Symptomatology. — When hydronephrosis is congenital and double, should the child be born alive, death usually occurs within a very short period, varying from a few hours to three or four months; in exceptional cases, however, life is more prolonged, and in one instance, recorded by Dr. Hare,[1] the patient attained the age of thirty-eight years. Again, all clinical signs of the condition may be absent throughout a long life, if it should be confined to one side, the opposite kidney being healthy, and if the sac should not attain any considerable size. Under such circumstances the hydronephrosis may be only discovered at post-mortem examination. In acquired cases the phenomena characteristic of the accumulation may be preceded by those due to its cause, more especially by symptoms of renal colic resulting from the passage of a calculus along the ureter, which either lodges there permanently, or sets up morbid changes in its walls which lead to the ultimate closure of the duct. The special signs of hydronephrosis may be summed up as an enlargement or tumor in the renal region, increasing more or less rapidly, usually unaccompanied with any pain or tenderness, occasionally presenting a lobulated outline, and having a soft, elastic, or fluctuating feel; while the urine is usually normal or but slightly altered, and in some instances comes away in large quantity suddenly, with simultaneous subsidence of the tumor, which subsidence may be permanent, or occasionally this event occurs from time to time, the enlargement again forming in the intervals between the excessive discharges of urine.

When first discovered, a tumor which is due to hydronephrosis corresponds in its situation to other forms of renal enlargement, occupying the lumbar region, and reaching back to the spine; but as the accumulation increases, it extends more or less upwards, and downwards into the hypochondriac and iliac regions, as well as in a forward direction. The size which it ultimately attains varies considerably, and an enormous tumor may be formed, completely filling the abdomen, and leading to great general enlargement of this part of the body, so that the origin of the swelling cannot be recognized, and it has under such circumstances been mistaken for an ovarian cyst. As it increases, it sometimes can be felt to present a distinctly lobulated outline; while it usually yields to the finger a sensation more or less clearly indicative of an inclosed collection of fluid, namely, a feeling of softness, elasticity, or fluctuation, which a change of posture does not affect. A hydronephrotic tumor is not in itself in the least degree painful or tender, as a rule, but it may be accompanied with pain due to its cause, such as a calculus in the ureter; and paroxysmal attacks of pain in the direction of this duct have been experienced in exceptional cases. More or less discomfort and uneasiness, or a sense of fulness or tension, may also be felt when the tumor becomes very large; and griping pains are occasionally induced in consequence of its interference with the intestines. Occasionally the swelling itself seems to be somewhat tender. When both kidneys are involved, of course there will be an enlargement on each side, but not usually to an equal degree. The percussion-sound is absolutely dull and toneless over the site of the tumor; but if it is not very large, the colon can generally be detected, by its special resonant sound, lying in front of it. Change of posture does not in the least influence the dulness.

The absence of any abnormal characters in the urine is an important fact in the clinical history of most cases of hydronephrosis, as, when only one kidney is involved, the opposite organ becomes hypertrophied, and forms an adequate quantity of healthy excretion. Occasionally it contains a small quantity of pus; and in connection with paroxysms of nephritic colic blood may be present. The discharge of a profuse quantity of urine, which is usually somewhat modified in its characters and composition, with the coincident disappearance of an enlargement in the renal region, is highly characteristic of hydronephrosis, indicating that some obstruction has been removed, and thus the accumulated fluid has been able to escape suddenly. Of course such an event can only take place under certain conditions, and it may be repeated a variable number of times, the ureter becoming again blocked up, and the urine

[1] Medical Times and Gazette, 1858.

consequently retained, with subsequent relief of the obstruction.

A hydronephrotic sac interferes more or less with neighboring structures, and thus may originate symptoms. The most frequent of these are due to impaired action of the intestines, there being constipation and flatulence, and complete obstruction of the bowels may be induced, or in other cases dysenteric symptoms may be excited. The stomach may also be affected, with consequent vomiting. In rare instances one or other of the chief veins is compressed; while the diaphragm and thoracic organs may be interfered with in extreme cases. The general health is also liable to be more or less affected.

The clinical course and ultimate issue in cases of hydronephrosis are variable. If the morbid condition is one-sided, should the obstruction be removed, and the retained urine escape, recovery may ensue, with partial or complete destruction of the affected kidney, the opposite organ assuming double duty, but it may subsequently become the seat of disease, and death may be the consequence. Very rarely does a hydronephrotic sac rupture internally and thus lead to a fatal result.

In some instances death has been preceded by uræmic symptoms, either in consequence of both kidneys being involved, or of a calculus obstructing the ureter leading from the healthy organ, or exceptionally even where one kidney was perfectly free and healthy. A fatal termination may also ensue from the immediate or remote effects of the removal by operation of the contents of a hydronephrotic sac. Peritonitis may be thus excited, or suppuration set up, with consequent wasting and hectic fever. The pressure-effects of the accumulation have in exceptional cases either been the actual cause of death, especially intestinal obstruction, or they have aided in bringing about this result.

Diagnosis. — Hydronephrosis cannot be diagnosed if the quantity of fluid accumulated is small; and it is only when the sac attains such dimensions as to give rise to a perceptible enlargement that the complaint can be recognized. With regard to its positive diagnosis, assistance may be derived from the past history, either revealing that the condition is congenital, or that there has been some cause likely to give rise to hydronephrosis, such as the passage of a calculus; and also indicating the clinical course of the case. The important characters of the enlargement are, that it usually occupies the ordinary site of a renal tumor, having the colon in front; that it is not painful or tender; and that it presents tactile sensations indicative of a fluid accumulation. The sudden discharge of a large quantity of urine, with subsidence of the tumor, is pathognomonic. Hydronephrosis may be mistaken for morbid conditions within the abdomen which are not connected with the kidney, where there is an accumulation of fluid, but especially for ascites or an ovarian cyst. This difficulty, however, should only be likely to happen if the sac attains a very large size, or if both kidneys are affected. Usually an ovarian tumor can be traced into the pelvis; it does not occupy the lumbar region, which is resonant, while it is entirely dull in front; and special modes of examination will reveal other characters pertaining to this disease. If a hydronephrotic sac becomes extremely large, it may be impossible to distinguish the two conditions, and cases have occurred in which tapping has been performed for a supposed ovarian cyst which proved to be hydronephrosis. The diagnosis between this condition and ascites might present difficulties if it were double, but the fluid being confined does not move about with change of posture, as it does in ascites, and thus no alteration is observed in the shape of the abdomen, in the seat of fluctuation, or in the percussion-sound. The history of the case, and the accompanying clinical phenomena, will in cases of doubt aid in the diagnosis.

With regard to other affections of the kidneys which are attended with enlargement, hydronephrosis is in but little danger of being confounded with any solid growth; but it has to be distinguished from swelling due to other accumulations of fluid, namely, renal abscess, pyonephrosis, or perinephritis, from hydatid disease, and from a simple cyst in the kidney, which in rare instances attains a very large size. Suppuration within or outside the kidney is usually acute in its progress; the enlargement is painful and tender; there may be superficial signs of suppuration; and general symptoms indicative of this process are more or less prominent. In connection with pyonephrosis pus is passed mixed with the urine, or there is a history of such admixture. The general system is also much affected, there being usually wasting, with hectic fever, and repeated rigors. Hydatid disease is almost always unilateral; other structures may be implicated at the same time; hydatid-fremitus may be elicited in some cases, or small hydatid cysts or echinococci may be passed in the urine. A simple cyst cannot be distinguished by any definite signs. The aspirateur may prove of much value in doubtful cases in the diagnosis between hydronephrosis and other morbid conditions.

Prognosis.—This is somewhat uncertain, and differs much in different cases, but there is always more or less danger to life. The chief circumstances which influence the prognosis are whether the hydronephrosis is single or double, and when it is single, the condition of the opposite kidney; the amount of the accumulation, and its effects on surrounding structures; the possibility of any obstruction being removed; and the effects produced on the general system. The chief sources of danger arise from the supervention of uræmic symptoms, from interference with the intestines or other organs, or from rupture of the sac, the last event being, however, extremely rare. Cases of unilateral hydronephrosis may go on for an indefinite time, if the accumulation is not large, and a cure may result if any obstruction can be got rid of, or in some instances after the fluid has been removed by operation. After either mode of evacuation, however, the fluid may reaccumulate, and after an operation suppuration is liable to take place. Double hydronephrosis is necessarily very serious, and uræmic phenomena usually lead to a fatal termination, but it is sometimes remarkable what a length of time life may be prolonged even in cases of this kind.

Treatment.—The indications for the treatment of hydronephrosis are, first, to endeavor to get rid of any obstruction to the escape of urine, or to cause the urine to pass by such obstruction; or, secondly, failing this, to remove the accumulated fluid by operation. The first indication can only be carried out in certain cases, where the escape of urine is prevented by some morbid condition causing pressure upon the ureter, or by internal obstruction of this tube, as by a calculus; or where there is some congenital closure of the urethra, which can be remedied. When an impacted calculus has originated hydronephrosis, careful manipulation and shampooing over the enlargement may be practised, and this has been attended with success, either in the way of keeping the accumulation within moderate limits, or even of getting rid of it altogether. If this plan of treatment is inadmissible, then comes the question of operation. Should the enlargement be unilateral and of small size, while there are no prominent symptoms, it is certainly advisable not to interfere; but should it be of considerable dimensions or progressively enlarging, thus becoming troublesome and evidently affecting adjoining structures injuriously, it is desirable to remove the fluid. This can generally be done with safety by means of the aspirateur, or it may be requisite to use a trocar and canula, and it will be well always to adopt antiseptic precautions. Should the fluid reaccumulate it may be again removed, and repeated tapping has been resorted to with success in some instances. In cases of double hydronephrosis it may also be advisable to operate, but no definite rule can be laid down. If only one kidney is involved, care must always be taken to try to preserve the opposite organ in a state of health, by regulating the diet, and maintaining a free flow of watery urine. The general system may require attention in cases of hydronephrosis; as well as any symptoms or complications to which this condition may give rise.

RENAL ABSCESS.

By Frederick T. Roberts, M.D., B.Sc., F.R.C.P.

Definition.—It is convenient to regard any accumulation of pus within the kidney as a renal abscess but this may originate in different ways, as was first clearly pointed out by Rayer. Thus, it may arise from suppuration in the substance of the kidney, following inflammation—*suppurative nephritis;* from pyelitis, with subsequent closure of the ureter, so that the pus collects within the renal pelvis—*pyonephrosis;* or from a combination of these conditions—*pyelo-nephritis.* From either of these causes the whole kidney structure may be ultimately destroyed, nothing being left but a sac containing pus, which is often mixed with other materials. Peri-nephritic or peri-renal abscess results from inflammation affecting the capsule and the tissues which immediately surround the kidney—*peri-nephritis;* the pus therefore accumulating around instead of within this organ. The formation of these abscesses is generally attended with prominent local and general

symptoms, and they usually tend to open in certain directions, thus giving rise to more or less serious consequences.

Synonyms. — Suppurative Inflammation of the Kidney; Nephritis Vera; Acute Interstitial Nephritis. Pyæmic abscesses have been separated by some writers from suppurative nephritis, their synonyms being metastatic or multiple abscesses.

Etiology.—The formation of one or more abscesses in the substance of the kidney may be due to the following causes: 1. Direct injury over the renal region, by which the kidney structure is wounded or contused, as from a stab, gunshot, blow, kick, or fall. 2. Irritation of the substance of the organ, especially by one or more calculi lodged there, by which inflammation may be excited, terminating in suppuration. Here may also be mentioned the fact that hydatid or other cysts in the kidney occasionally undergo inflammatory changes, ending in the formation of an abscess; and that morbid growths occasionally excite suppurative inflammation, or may even break down into a kind of abscess, as in the case of tubercle. 3. Suppuration in the renal pelvis, ureter, bladder, or urethra, to which the same process in the kidney is secondary, being originated either by direct extension, through the agency of the blood, or in some other way not definitely determined (*see* Consecutive Nephritis). 4. Embolism, with consequent hemorrhagic infarctions, which may ultimately become converted into abscesses, involving also the renal tissues. 5. Pyæmia, in the course of which disease the kidneys are liable to become the seat of abscesses, though much less commonly than some other organs. In this class of cases the suppurative process is also probably due to small embola of a septic nature. It may follow pyæmia from any cause, but is especially common after suppuration of the urinary passages, though, on the other hand, the kidneys may be free when disease in these passages is the cause of pyæmia. 6. Extension from surrounding structures or neighboring organs in very rare instances.

Pyonephrosis is usually preceded by chronic pyelitis, which leads to the production of pus, and this accumulates along with the urine in the renal pelvis, just in the same way as urine alone collects in cases of hydronephrosis, in consequence of some obstruction preventing its escape through the ureter. The pyelitis generally owes its origin to calculous disease, and it is the impaction of a stone which is the most frequent cause of the obstruction. The affection may, however, be due to retained and stagnant urine which has become decomposed, or to irritation by parasites or by morbid products, such as cancer or tubercle, and either of these may block up the ureter, or this effect may be due to a blood-clot, inspissated pus, or mere inflammatory swelling or ulceration.

Perinephritis and its consequences most commonly follow suppuration in connection with the kidney or its pelvis, the inflammatory process being set up either by mere extension, or from the bursting of an accumulation of pus within the kidney into the surrounding structures. Rokitansky says that it is particularly liable to supervene whenever a tedious inflammatory process is kept up by calculous disease; and in such cases one or more calculi may also find their way into the peri-renal tissues, and thus increase the irritation. The escape of urinary fluid from the kidney into these tissues may likewise set up perinephritis. More or less inflammatory changes around the kidney are likely to be excited by morbid growths in this organ, especially carcinoma, but these are of a more chronic nature, and lead to the formation of adhesions. Occasionally perinephritis originates from some external violence inflicted over the renal region; and it has in rare instances been regarded as idiopathic, resulting from a cold. Niemeyer[1] states that he had seen one case in which a peri-cystitis extended along the ureter to the fat around the kidney.

Anatomical Characters. — Suppuration in the substance of the kidney is usually preceded by marked congestion, either uniform or scattered here and there throughout its structure. Hence the organ is of a deep red color, enlarged and softened, while a quantity of bloody fluid escapes on section. It then becomes infiltrated with exudation, the tubules are filled with epithelium, nuclei, and granules, and the interstitial tissue presents abundant leucocytes; consequently the color alters, becoming whitish or yellowish, and suppuration afterwards takes place in isolated spots, which may extend and coalesce, until finally a large portion or even the whole of the kidney is destroyed, being converted into a bag of pus, which may attain a large size. Abscesses in pyæmic cases are usually separate, of small size, and scattered in greater or less number in the midst of the renal structures, both kidneys being involved. Other forms of renal abscess are generally limited to one organ. The collection of pus may open into the renal pelvis, and be discharged by the ureter, the remains of the kidney subsequently shrinking; or it may burst in certain other directions,

[1] Text-book of Practical Medicine, vol. ii. p. 40.

to be presently indicated. In exceptional instances the contents of an abscess become inspissated and caseous, or even calcareous, a cure being thus effected.

Pyonephrosis is preceded by chronic pyelitis, and hence the lining membrane of the pelvis and infundibulum presents marked changes. It is altered in color, being paler than normal, and often of a gray or slate color; while enlarged veins are frequently visible upon it. It is also thickened, and either unusually tough and firm, or softened. The epithelium is destroyed, erosions are common, and in some instances actual ulceration is observed. Deposits of exudation, caseous matter, or other morbid products upon its surface are not uncommon. The pelvis, infundibulum, and calices become distended to a variable degree, and the renal tissue is then involved in different ways, until finally only remnants of it are left, or it may even be destroyed altogether. The organ may be merely compressed by the accumulated fluid, and becomes gradually wasted, as already described in connection with hydronephrosis. Or it is implicated in the suppurative process, either by direct extension, or in isolated spots in its substance—*pyonephrosis;* and thus undergoes disintegration and destruction. In the condition last mentioned it is affirmed that abscesses seated deeply in the cortical substance, and apparently shut in, can be traced to communicate with the pelvis by a tract of suppuration extending along the tubules to the apices of the pyramids, showing their origin in extension of suppuration along these tubules. According to the extent of the destructive processes just indicated will the morbid appearances vary. Thus there may be a sac of variable size, corresponding to the dilated pelvis, containing pus and other products, with scattered abscesses throughout the kidney; or the organ may have entirely or almost entirely disappeared, nothing remaining but a sacculated space, which may ultimately attain a considerable size. Even should any renal tissue be left undestroyed, it will probably be found to have undergone morbid changes of a chronic inflammatory nature.

The contents of the cavity in cases of pyonephrosis consist chiefly of pus, usually mixed with retained urine. The latter tends to decompose, and consequently the fluid becomes ammoniacal and alkaline in reaction, while the pus is found to have undergone more or less alterations from its healthy characters. The quantity of fluid thus accumulated differs much in different cases, and it may be very considerable. Mixed with it are not uncommonly found other materials, such as blood, calculi or their *débris*, portions of morbid growths, precipitates of urates or phosphates, or, in exceptional instances, scales of cholesterin. In course of time deposits are likely to form upon the inner surface of the sac, usually consisting of secondary phosphates. The purulent fluid may also become gradually inspissated by the precipitation of calcareous and magnesian phosphates and carbonates, and this may lead to a practical cure, the contents becoming more or less putty-like or chalky, and the walls of the cavity contracting upon them. These walls sometimes become calcified or even imperfectly ossified, as well as the septa which partially divide the interior of the sac. In other instances the pus escapes through the ureter, in consequence of the removal of the obstruction, the sac then shrivelling up, or it may alternately fill and be empty for a variable number of times. The accumulation of pus may also open in certain directions.

In perinephritic abscess pus is found around the kidney, suppuration taking place in the surrounding structures, which are chiefly composed of adipose tissue. This is preceded by the ordinary signs of inflammation. According to the cause of the affection, the abscess may or may not be found to communicate with the interior of the kidney; and when such a communication exists, urine, calculi, or other materials which have escaped from this organ, may be found mixed with the pus. The quantity of matter formed is often very considerable. A perinephritic abscess tends to burst in certain directions, if allowed to take its course, and as this termination may also happen in the case of purulent accumulations within the kidney, it will be convenient to indicate here the directions in which such opening may occur. In the first place the abscess may make its way to the surface, and burst externally, either in the lumbar region, in the iliac fossa, at the upper part of the thigh, the matter passing beneath Poupart's ligament along the psoas magnus muscle, or even in the gluteal region. Occasionally there is more than one external opening. Or it may rupture internally, communicating either with the colon or, on the right side, with the duodenum; with the peritoneum; or, rarely, with the pleura or lung, after perforating the diaphragm. Pathological consequences are likely to arise from these modes of termination, such as peritonitis or pleurisy; and when the abscess bursts externally, sinuses with fistulous openings are liable to remain. In a case which has long been under the observation of the writer, two such sinuses exist, which are constantly discharging, the one opening in the lumbar region, the other in the iliac fossa.

In cases where suppuration takes place in connection with the kidney, especially if chronic, it is not uncommon to find

other parts of the urinary apparatus involved, to which, as already pointed out, the renal condition is usually secondary. For instance, there may be cystitis, inflammation and suppuration of the ureter, or suppuration in the urethra. Moreover, if there be a chronic discharge of pus from one kidney, the opposite organ is liable to become the seat of albuminoid or other forms of disease; and other organs may be similarly affected. Pulmonary phthisis may also be set up.

SYMPTOMS.—The formation of abscesses in the kidney itself may occur without any definite symptoms pointing to implication of this organ. This is especially liable to happen in cases of pyæmia, or when the suppuration is secondary to a similar process in the urinary passages or bladder. In other instances symptoms connected with the kidney are present, but none characteristic of this disease; and it may happen that an abscess which has not been previously recognized bursts into the renal pelvis, its existence being only indicated by an unexpected discharge of purulent urine. Usually the complaint is acute, and the phenomena which may be anticipated in its course, *local* and *general*, are of the following nature.

Pain is experienced over one renal region, which often attains considerable intensity, is liable to exacerbations, and shoots downwards towards the hypogastrium, scrotum, or upper part of the thigh. It is much aggravated by movement, and also by pressure, there being in some instances extreme tenderness over the loin. When suppuration takes place, the pain may become of a throbbing character. Retraction of the testicle is sometimes observed. Micturition may be too frequent; while the urine is generally much affected, both as to its amount and characters. This excretion is diminished in quantity, and may be almost suppressed. That which is passed is of a deep color, concentrated, and frequently contains an admixture of albumen or blood; but neither hæmaturia nor albuminuria is constant. As suppuration progresses, should an abscess attain a sufficient size, it affords external objective signs of its presence. A fulness or tumor forms in the region of the kidney, which comes to yield a sensation of more or less elasticity or fluctuation. Ultimately, should the abscess tend to open externally, the superficial structures present signs of inflammation, and pointing may be observed. The purulent accumulation may, however, burst into the pelvis of the kidney, and this event is indicated by a copious discharge of pus with the urine, and a coincident diminution or disappearance of the swelling. The purulent discharge may soon cease, or it may continue as a chronic condition. The clinical signs of the evacuation of a renal abscess in other directions will be presently indicated. It must be remembered that even after such an abscess has formed, and its existence has been recognized, it may undergo a curative process without opening in any direction.

Acute suppurative nephritis is usually ushered in by rigors, and these frequently continue at more or less regular intervals during the progress of the disease, especially when pus has formed. There is marked pyrexia, with its concomitant phenomena: and nausea and vomiting are often prominent symptoms. The fever tends to assume a low type at an early period, and in many cases the symptoms become of a marked typhoid character, with a dry brown tongue, sordes on the lips and teeth, and low nervous phenomena, such as mental wandering, muttering delirium, a tendency to stupor or coma, tremors or twitchings, or convulsive movements. These phenomena are due partly to the suppurative process, partly to the interference with the renal functions and consequent blood-poisoning. When they occur, they usually lead to a fatal termination.

It has already been remarked that pyæmic abscesses in the kidneys do not generally give rise to any symptoms attracting attention to these organs. Such abscesses may, however, be suspected if, in a case of pyæmia, there is evident tenderness over the lumbar regions, while the urine is much diminished in quantity, and contains blood or a considerable amount of albumen. If suppuration follows disease in the bladder or urinary passages, the progress is more chronic, and the general symptoms assume a more or less hectic type.

Pyonephrosis and its consequences are usually, but not invariably, preceded by symptoms of pyelitis, and especially by a discharge of purulent urine, which has lasted a variable time. When the obstruction occurs which prevents the escape of the pus and urine from the pelvis of the kidney, the pain and suffering become aggravated, especially if they are due to a calculus, micturition becomes more frequent, and provided the pyelitis is unilateral, the urine which is discharged ceases to contain pus and is clear, because it comes from the healthy organ. At the same time a fulness or tumor forms in one renal region, which increases more or less rapidly, is painful and tender, and comes to present a sensation of softness and elasticity or fluctuation. This fulness is usually confined to the loin, or occupies the space between the margin of the thorax and the iliac crest; it may, however, extend across the middle line of the abdo-

men. Should the obstruction be got rid of, the fulness subsides, with coincident appearance of abundance of matter in the urine. The outlet may again become blocked, the tumor forming anew, and again it may subside, owing to the passage once more becoming free. This filling and emptying of the pelvis of the kidney may alternate for a number of times. In some cases of pyonephrosis the sac ruptures either internally or externally, or it is emptied by operation; in exceptional instances it remains as a chronic condition, the patient gradually sinking from its effects, and in others the contents become by degrees inspissated and dried up, a cure ultimately resulting. It is impossible to determine clinically in cases of pyonephrosis, with any degree of certainty, when the kidney structure itself is involved in the suppurative process. There may be indications of the development of chronic Bright's Disease, in the occurrence of diminished discharge of urine, albuminuria, dropsy, and other symptoms of this affection. The general symptoms usually associated with pyonephrosis are those indicative of more or less pyrexia, which tends to assume a hectic type, with much wasting, rigors, and night-sweats. Signs of pulmonary consumption and other secondary morbid conditions may also arise in the course of the disease.

Perinephritic abscess may, according to its cause, be preceded or not by symptoms indicative of suppurative or other disease in connection with the kidney itself. In the former case, if an accumulation of pus within this organ or its pelvis opens into the surrounding tissues, this event may be signalized by a sudden pain in the loin, and evidences of more or less constitutional shock. If perinephritis is idiopathic, and independent of renal disease, the complaint is likely to be ushered in with rigors. With regard to the special symptoms which characterize this condition, in the first place the pain seems to be superficial, soon becomes throbbing, and is markedly aggravated by any movement which affects the part, while tenderness becomes excessive. The renal functions are liable to be more or less disturbed, but this is by no means always the case; while, unless the perinephritis is associated with some affection of the kidney itself, the urine does not contain any pus or blood as a rule, nor does it present any special characters. Hæmaturia may, however, be observed. A swelling forms in the loin, and it usually comes to present a feeling of tolerably distinct fluctuation, as the pus continues to accumulate. The abscess generally makes its way towards the surface in the lumbar region, but it may progress in a forward direction, or pass downwards along the psoas magnus muscle and under Poupart's ligament to the upper part of the thigh, or into the gluteal region. If it becomes superficial in the loin, objective signs of inflammation appear in this region, and the subcutaneous tissue becomes œdematous. Ultimately, if not evacuated artificially, the abscess will probably open externally, but it may burst in other directions. Perinephritis is necessarily attended with more or less severe general symptoms, of a febrile character.

Either of the purulent collections within or around the kidney, the clinical history of which has been just sketched, may open internally into certain parts, and it is requisite to indicate the clinical signs of the more important of these modes of termination. Should the abscess burst into the peritoneal cavity, there will probably be sudden pain at the seat of communication, which may be very severe and of a burning character, accompanied by symptoms of more or less shock or collapse, but these phenomena may be absent altogether. Subsequently signs of peritonitis appear, this complication running a rapid course, and the termination being always fatal. Should a communication be formed with the intestine, this event is characterized by the passage of pus in the stools, which may come away suddenly and in large quantity, while the swelling subsides. If the pus comes from the kidney itself, there may at the same time be a discharge of purulent urine. This mode of termination may lead to the complete evacuation and ultimate cure of the abscess. The opening through the diaphragm into the pleural cavity, which is a rare event, may be immediately evidenced by symptoms of interference with the respiratory functions, accompanied with physical signs of the presence of fluid in the chest; and the phenomena indicative of pleurisy speedily supervene. This is a very untoward termination. If the purulent collection communicates with the lung, it passes into the bronchi and is expectorated, and a large quantity of matter mixed with urine may thus be expelled. This is also a serious event, but not necessarily fatal.

The course of events which occurs after renal or peri-renal abscess opens externally or is evacuated by operation, varies in different cases. It may heal up immediately or gradually, no further accumulation taking place; or, on the other hand, the case ends fatally sooner or later. In other instances the matter collects again, and another opening is formed, perhaps in some other direction, or two more operations are required, which may lead to ultimate recovery, as happened in a case which came under the writer's observation. Again, one or more

sinuses or fistulæ may remain, discharging pus, which may at the same time come away with the urine. The condition last-mentioned is accompanied in time with general wasting, fever, night-sweat, and a tendency to hectic; while phthisis or albuminoid disease is liable to be set up, if the discharge continues for any length of time. By judicious management, however, the general health may even in these cases be maintained in a fair condition for a long period, and secondary lesions warded off.

Diagnosis.—It will only be practicable to touch briefly upon the principal points relating to the diagnosis of suppuration within or around the kidney. In the first place, it must be remembered that under certain circumstances renal abscess may be entirely latent, and cannot be recognized during life, especially in cases of pyæmia. In other instances the diagnosis presents little or no difficulty, the nature of the disease being clearly indicated by the history and course of symptoms. Neither pyo-nephrosis nor perinephritic abscess is ever likely to be clinically latent, each of these conditions being usually indicated by prominent local and general signs.

Occasionally a difficulty is experienced in distinguishing a collection of pus within or around the kidney from neighboring morbid conditions. The chief of these to be borne in mind are abscess or hydatid disease of the liver or spleen; localized accumulation of fluid in the peritoneum; and suppuration in the superficial structures, depending upon bone disease or other causes. The diagnosis must be determined by a careful consideration of the history of the case; the precise situation and limits of any enlargement; and the presence or absence of renal symptoms. It may happen, however, that a large accumulation of pus forms within the pelvis of the kidney, without the occurrence of any urinary symptoms, as in a case recorded by Caffe,[1] where a supposed cyst in the spleen, which was operated upon by Nelaton, proved to be pyonephrosis. Again, when a renal or peri-renal abscess, in making its way to the surface, passes into some unusual locality, it may be difficult to trace it to its source, and to distinguish it from other abscesses. Sinuses and fistulæ remaining after the collections of pus have opened externally, may also present obscurity as to their origin. In one such case which came under the writer's observation, the simultaneous discharge of purulent urine proved that sinuses opening externally had originated from suppuration within the kidney, and probably from pyonephrosis.

[1] Gaz. des Hôp. 1855.

The next point bearing upon the diagnosis is to distinguish suppurative diseases from other affections of the kidney which cause enlargement in connection with this organ. There is not likely to be any difficulty with regard to solid growths, such as cancer, though these do present in some instances a sensation of quasi-fluctuation which might mislead; the chief conditions, however, which must be borne in mind are fluid accumulations associated with the kidney, namely, hydronephrosis, cystic disease, and hydatids, which yield to palpation sensations resembling those afforded by a collection of pus. Such a collection is, however, distinguished from the conditions just mentioned by the history of the case; the presence of pain and tenderness in the renal region, usually accompanied by prominent urinary symptoms and marked alterations in the urine, as well as with general symptoms indicative of suppuration; and frequently by the more acute progress of the case. Hydatid cysts may yield hydatid fremitus; other organs are usually similarly affected; and vesicles may be passed with the urine. It must not be forgotten that these cysts may ultimately suppurate; while hydronephrosis, owing to decomposition of the retained urine, occasionally terminates in pyonephrosis.

A collection of pus in connection with the kidney being recognized, it then becomes necessary to determine whether it is due to renal suppuration, pyonephrosis, or perinephritis; and, if possible, to trace the morbid condition to its cause, whether injury, calculus, tubercular disease, &c. These conclusions can only be arrived at by a careful consideration of each case in all its details, past and present, and much difficulty may be experienced, while it must be borne in mind that the conditions may be more or less combined. As distinguishing pyonephrosis from abscess in the kidney, the former is preceded by symptoms of pyelitis, perhaps for a considerable time; there may be clinical indications of some obstruction causing the retention of pus, with coincident clearing-up of the urine; and alternate filling-up and evacuation of the renal pelvis may take place, with corresponding changes in the characters of the urine, which is very characteristic. The diagnosis of perinephritic abscess is founded upon the superficialness of the pain and tenderness, with more marked exacerbation on movement; the signs of superficial inflammation with subcutaneous œdema; and the absence of any marked changes in the urine, though it must not be forgotten that this excretion is sometimes much altered, even when there is no communication with the kidney.

The implication of the kidney or its

pelvis secondarily, as a consequence of previous disease in the bladder or urinary passages, may be very difficult to ascertain. The development of local pain and tenderness in the renal region may call attention to this complication, especially if accompanied with the escape of a considerable amount of pus with the urine, and with more marked general symptoms than were previously observed, namely, fever, wasting, and hectic. It may happen that a more or less fluctuating fulness forms over the region of the kidney, and this will establish the diagnosis.

The last point relating to the diagnosis is the recognition of the bursting of an accumulation of pus associated with the kidney into the various internal structures, and the conditions resulting therefrom. If it is known that such an accumulation exists, the phenomena already described as characteristic of the different modes of termination usually sufficiently indicate what has happened, particularly if any enlargement over the region of the kidney subsides simultaneously.

Prognosis.—The formation of a collection of purulent fluid within the kidney, whatever be its cause, is an event necessarily attended with much danger, and in a considerable proportion of cases leads, sooner or later, to a fatal issue. This may result either from interference with the renal functions and its consequences; from acute general symptoms of a typhoid character, due to the suppuration; from the bursting of the accumulation into internal parts; from gradual wasting and hectic in connection with the chronic formation and discharge of pus; or from secondary lesions set up in consequence of long-continued suppuration. Recovery may take place, however, either after the purulent collection has been evacuated spontaneously, or by operative interference; or as the result of inspissation or calcification of the pus, and shrinking of the sac containing it, so that no further mischief results, although the kidney is more or less destroyed, the opposite organ enlarging and performing extra work.

The prognosis will be influenced by various circumstances, among which the following demand special notice: In the first place, the cause of the renal affection is important. For example, if it is associated with pyæmia the prognosis is necessarily extremely grave, although the fatal termination then results rather from the general condition than from the local lesion. Again, when suppuration in the kidney or its pelvis arises as a complication of disease of the bladder or urinary passages, or when pyonephrosis follows tubercular or cancerous pyelitis, the case is exceedingly unfavorable. When the cause is of a merely local nature, such as injury or calculous disease, the prognosis is more hopeful. It is also affected by the amount of the purulent accumulation, and is much worse if both kidneys are involved. Further, the course of events will materially modify the prognosis. Suppose the case to be one of pyonephrosis, the removal of the obstruction preventing the escape of the pus and urine will be a favorable sign; and even if there be alternate filling and emptying of the sac for a number of times, recovery may ultimately ensue, though with destruction of the kidney. If a renal abscess makes its way towards the surface and opens externally, especially in the loin, a cure may also result, though most cases which terminate in this way succumb sooner or later. Undoubtedly judicious treatment, having for its object the removal of the fluid by operative interference, will materially affect the prognosis under these circumstances, and may lead to a favorable issue which could not otherwise be expected. The bursting of any collection of pus into internal parts is always a very serious event. If the communication should form with the peritoneum or thoracic cavity a speedily fatal termination may be anticipated; if with the bowel, the prognosis is a little more hopeful, though it is only in very exceptional cases that recovery takes place, the progress towards death, however, being usually slow and gradual.

With regard to perinephritic abscess, much that has been stated above applies also to this morbid condition. If the kidney is healthy, and the perinephritis is not secondary to suppuration within the organ, the prognosis is decidedly more favorable than under opposite circumstances. The chief dangers arise from the abscess bursting inwardly, in the different directions already indicated; and from the general symptoms which are associated with it, either acute or chronic.

In all these conditions, the previous state of the patient will to some extent influence the prognosis; and it must also be guided by the evident effects upon the constitution which they induce, especially when they terminate in a chronic discharge of pus, some individuals being much less affected by this event than others.

Treatment.—If symptoms point to the occurrence of acute inflammation, either affecting the kidney itself or its surrounding tissues, which is likely to lead to suppuration, the local removal of blood from the corresponding lumbar region is decidedly indicated, provided the condition of the patient admits of this measure. It is in traumatic cases that it would most probably be required, while

of course it is not to be thought of in pyæmia, and is seldom admissible if there has been previous disease of the urinary apparatus. Blood may be removed by means of leeches or cupping, the quantity taken away being determined by the state of the patient. Cupping may be performed to the extent of from four to twelve ounces; or from a half-a-dozen to a dozen leeches may be applied. Free dry-cupping may be practised when blood cannot be abstracted. The persistent application of cold has been advocated, by means of the ice-bag or of ice-compresses. This plan of treatment may be useful at an early period, with the view of checking or limiting the inflammatory process, but if this has advanced, it seems preferable to employ hot fomentations at frequent intervals, to which some anodyne may be added, along with large and well-made linseed-meal poultices, one of which should be applied quite hot after each fomentation. Warm hip-baths are also likely to be of much service. These measures are especially called for if suppuration has evidently set in, in order to encourage the advance of the abscess towards the surface. The general management is of considerable importance. The patient should be kept as quiet as possible in bed; and on low diet, consisting of liquid food, water, barley-water, or other simple drinks being also freely allowed. No medicine can have any direct influence as regards the inflammatory condition, but the bowels should be freely opened, enemata being employed for this purpose.

If suppuration in the kidney takes place slowly, no active measures can be adopted to prevent it. Should pus accumulate in the renal pelvis owing to some obstruction preventing its escape, this might possibly be got rid of by careful shampooing and manipulation along the ureter, as described under hydronephrosis. If this result could be effected, treatment directed to the pyelitis would then be indicated, so as to endeavor, by means of astringents and other remedies, to check the formation of matter, at the same time the cause of the disease being got rid of, if possible. Should the kidney-affection be developed secondarily to disease in other portions of the urinary apparatus, of course this primary disease must receive due attention, especially if connected with the bladder or urethra.

Sooner or later it happens in a good many cases that a collection of pus in connection with the kidney attains such a size as to justify or demand its removal by operation. The time when this has to be resorted to must depend on individual judgment, but it must be remembered that there is always a danger of the abscess opening into some internal part, and also of the kidney being entirely destroyed, and therefore unnecessary delay ought to be avoided. From his own experience, the writer would certainly recommend that, whatever the cause of the accumulation of pus might be, whether renal abscess, pyonephrosis, or perinephritis, the matter should first be removed by means of the aspirateur, and the operation might be repeated even more than once if the fluid should again collect. Antiseptic precautions should be duly employed. In a case of supposed perinephritis which came under the writer's observation, aspiration was performed on two occasions, and the patient then made a good recovery. He died from some other affection some years afterwards, and at the post-mortem examination no trace of any suppuration could be discovered, but the kidney was wasted and shrivelled to merely a small remnant. If aspiration does not succeed, then it is requisite to make a free opening, and especially if there are signs of superficial suppuration. This should usually be made in the posterior lumbar region, and the patient should lie in such a position as would favor the escape of the matter. The further management of the case must be conducted on surgical principles, and need not be discussed here.

During the progress of the affections now under consideration, symptomatic treatment is always called for more or less. Pain and restlessness may be relieved by opium, subcutaneous injection of morphia, chloral hydrate, and other remedies of this class. Typhoid symptoms call for the active administration of stimulants, supporting food, and quinine or bark with acids. These are also indicated, though less actively, where there is a chronic discharge of matter, with fever, wasting, and hectic, and under these circumstances preparations of iron and cod-liver oil are often very valuable. Vomiting, constipation, diarrhœa, or other symptoms may also demand attention. Again complications, due to the bursting of an abscess inwardly, or to other causes, are liable to call for treatment; as well as sequelæ, such as sinuses and fistulæ, or secondary affections induced by a chronic discharge of pus. These must be treated on general principles, and no special directions can be given.

It must be remembered that suppuration in connection with the kidney may arise under circumstances in which no particular treatment can be adopted, even if the condition is known to exist. This is the case, for instance, in pyæmia, where all that can be done is to attend to the general state. It may be remarked,

finally, that if any morbid condition is known to exist, which might lead to renal suppuration, such as a traumatic lesion, calculous disease, or hemorrhagic infarction, precautions might be taken to prevent this occurrence, by keeping the patient at rest, avoiding every cause of renal irritation, and applying cold locally.

TUMORS AND NEW GROWTHS OF THE KIDNEY.

By Frederick T. Roberts, M.D., B.Sc., F.R.C.P.

Definition.—The expression "renal tumor," or "tumor of the kidney," is used in a somewhat indefinite sense, and is generally made to include several pathological conditions which are entirely distinct from each other in their nature and origin. Thus it is applied to any form of enlargement, which depends either upon a morbid state of the kidney itself, upon some fluid accumulation within its pelvis, or upon perinephritis and its consequences. It therefore comprehends conditions which have already been described in previous articles, in addition to certain new formations or growths in connection with the renal apparatus. It must be mentioned, however, that such new formations by no means necessarily cause enlargement of the kidney, at any rate to such a degree as to render the organ recognizable as a tumor during life. Nevertheless it will be expedient to discuss in the present article all morbid conditions coming under this category, which are not elsewhere considered.

General Summary. — The diseases belonging to the class of new formations which it is proposed now to consider, are indicated in the following table :—

I. Cystic formations.	1. Simple cysts. 2. Congenital cystic degeneration. 3. Cystic degeneration in adults.
II. Malignant growths.	Encephaloid, Scirrhus, Colloid, Epithelioma, Melanosis, &c.
III. Non-malignant growths. . . .	Sarcoma (?), Fibroma, Lipoma, Myxoma, Glioma, Angioma. Adenoma, &c.
IV. Tubercular disease.	Nephro-phthisis.
V. Syphilitic disease.	
VI. Parasitic formations.	1. Hydatids—Echinococcus hominis. 2. Cysticercus cellulosus. 3. Strongylus gigas. 4. Bilharzia hæmatobia, &c.

Before entering upon the separate discussion of these morbid conditions, it will be convenient to point out the general characters of a *renal tumor*, by which it can usually be distinguished from other abdominal enlargements :—1. The situation of the tumor is of much importance. In the first instance it occupies more or less of the lumbar region, in the interval between the margin of the ribs and the iliac crest. It is often more apparent to inspection and palpation towards the front or lateral portion of this region than posteriorly, as there is more resistance in the last direction, but the fingers cannot be passed behind the swelling, so as to feel its hinder border. Manipulation will show that the enlargement does not extend into the pelvis ; and it can also usually be ascertained by palpation or percussion that it does not pass upwards within the margin of the thorax, though it may reach more or less into the hypogastrium. In a forward direction it may also encroach upon the abdominal cavity to a variable extent. 2. Palpation may reveal that the outline of the tumor corresponds more or less distinctly to the shape of the kidney. Its lower and anterior limits can generally be felt, and it is rounded on these aspects. The surface is often smooth, but may be irregular ; while the consistence differs according to the cause of the enlargement, though it is usually firm. 3. The tumor is generally completely fixed, and its position can never be influenced to any appreciable extent by manipulation, or by the dia-

phragmatic movements accompanying deep breathing. 4. Percussion gives important information. Over the greater part of the enlargement there is absolute dulness, which extends posteriorly to the spine. In front, however, a line of tympanitic resonance can be usually elicited, in consequence of the colon lying in front of the kidney, and more or less of the small intestines may also occupy this position, and thus influence the percussion-sound. On the right side, even if a renal tumor cannot be separated from the liver by palpation, percussion may yield an intestinal note at its upper end, and thus the two organs can be distinguished. The sensation felt by the finger on percussion varies according to the cause of the enlargement, being frequently, however, that of firmness and resistance. Elasticity, fluctuation, or hydatid-fremitus may be felt in certain conditions.

It must be noted that renal enlargements are liable to deviate considerably from the general description just given, and it is necessary to be prepared at the outset for such deviations. For example, an accumulation of fluid or a solid growth may attain such dimensions as to pass altogether beyond the limits of a renal tumor, sometimes indeed completely filling the abdominal cavity, so that, except by the history of its seat of origin and progress, it will be impossible to determine its connection with the kidney. Sometimes a growth is limited to one end of the organ, and thus seems to be connected with some adjacent structure. Again, a renal tumor occasionally presents pulsation and a bruit. One important mode of examination in doubtful cases consists in the use of the aspirateur or exploratory trocar, which may clear up any difficulty experienced in determining whether an enlargement is of renal origin, as well as in making out its exact nature.

Having given this general outline, the several morbid conditions will now be considered in the order in which they are enumerated in the table given above.

I. Cystic Formations.

1. *Simple Cysts.*—These are of not infrequent occurrence in kidneys which are otherwise perfectly healthy, especially in elderly subjects, and they are commonly found in these organs when they are the seat of the granular contracted form of Bright's Disease.

With regard to their pathology, it is a well-established fact that these cysts originate mainly in dilatation of portions of the urinary tubules, but some of those formed in Bright's Disease are due to distension of the Malpighian capsules. Why dilatation of the tubules should take place in healthy kidneys is not very clear, but it has been attributed to blocking-up of their channels by fibrinous particles. The development of cysts in the granular kidney is more evident, for the ducts are obviously obstructed at intervals, either by plugs of exudation, or as the result of pressure upon their exterior by contracting fibrous tissue. Consequently the intermediate portions become distended. Two other views have been advanced to account for the origin of these cysts. Simon attributed them to great enlargement and development of the epithelial cells lining the urinary tubules; while it has also been maintained that they are developed out of the intertubular connective tissue. Neither of these theories has, however, gained much acceptance. In the rare cases in which a cyst in the kidney has attained large dimensions, there has been an obscure history of external injury.

The cysts which are observed in otherwise healthy kidneys are usually superficial, often projecting somewhat above the surface, and when the capsule is removed, their contents may escape. Some may be situated more deeply, but they are chiefly confined to the cortical portion. They vary in number and size; and may be scattered or grouped. Generally they range in size from a pea to a nut or walnut, but may be very minute, or, on the other hand, a cyst in rare instances reaches large dimensions, so that it occupies a considerable portion of the abdominal cavity, and contains a large quantity of fluid. The walls are very thin and delicate, and indeed the superficial cysts sometimes appear to have no structure between them and the capsule of the kidney. The contents are usually fluid, clear, transparent, and of a yellowish color. This fluid is not of the nature of urine, for it very rarely contains urea, though more frequently a small amount of uric acid is found dissolved in it. It is generally albuminous, and contains carbonates and phosphates, as well as in some instances a good proportion of cholesterine. A jelly-like or colloid substance is also commonly found in these cysts, varying in consistence from a thin gelatinous fluid to an almost solid material. This may completely fill the smallest cysts, but usually floats in the fluid as irregular masses. In a case recorded by Dr. Hare,[1] the contents of a large cyst were fluid when first removed, but set into a tremulous jelly in a few minutes after exposure to the air.

The cysts observed in the granular kidney are more numerous than those just considered, being often in large numbers, and always of small size, many

[1] Pathological Transactions, vol. iv. p. 199.

of them being very minute, while they rarely become larger than a pea. They are scattered chiefly through the cortical substance, and may be so abundant as to make this appear as if it were not atrophied. In the pyramidal portion they are sometimes elongated, and present a moniliform appearance, being placed end to end. Their walls are thick and firm, and a delicate lining of epithelium may be perceptible. In cysts which originate from Malpighian corpuscles, the remains of the vascular tufts may be discovered. The contents are similar to those in the cysts already described.

These simple cysts do not give rise to any clinical signs of their presence, unless one of them should attain such dimensions as to form a perceptible tumor, which only happens in extremely exceptional instances. Such a tumor may, however, be of a considerable size, compressing and interfering with surrounding structures more or less. It is painless, and presents a sensation of softness or fluctuation. The condition is very liable to be mistaken for hydronephrosis, and perhaps also for hydatid disease. The past history and the use of the aspirateur might afford some assistance in diagnosis. Of course when the cysts are associated with the granular kidney, there will be the usual symptoms characteristic of this disease.

2. *Congenital Cystic Degeneration.*—This is a very remarkable morbid condition, but it is more of pathological than of clinical interest. Its mode of development is doubtful. Virchow and Förster have shown that the cysts have their origin in the urinary tubules and Malpighian bodies, as is the case with the simple cysts already described. Virchow maintains that the cause is to be found in inflammation of the straight ducts in the pyramidal portion of the kidney, occurring in the fœtus in utero, an embryonic nephritis. Consequently the walls of these ducts adhere, and their channels become closed up. The result is that the urine cannot escape from the kidney, and its tubules become dilated at intervals, as well as the Malpighian capsules. The minute pouches thus formed enlarge and become developed into cysts, being at the same time separated from each other, and the intervening portions of the tubes become obliterated. Virchow further holds that the inflammation depends upon the impaction of crystals of uric acid and urates in the ducts. As a consequence the renal papillæ waste, and the pelvis becomes obliterated. Koster has started another view as to the pathology of congenital cystic disease, namely, that it is due to a primary want of development of the apparatus for carrying away the urine, analogous to atresia ani and other malformations of this kind. In favor of this theory he advances the fact that the calices, pelves, and ureters are absent in many instances, but this is not always observed. The fact that other congenital malformations affecting the limbs and other parts exist in some cases, also seems to support this view. It is not improbable that both theories are correct in different instances.

Congenital cystic degeneration of the kidneys almost always involves both organs. They are usually more or less enlarged, and may equal in size adult organs. Specimens have been found to measure as much as six inches in length, and four inches in width and thickness. In a case described by Dr. Duffey,[1] each kidney weighed six ounces. On the other hand, in exceptional instances the organs are much diminished in size, and shrivelled. Their surface is generally irregular, owing to the projection of cysts, but it may be quite smooth. On section the kidney is found to be converted to a variable degree into a mass of cysts, which are often in great numbers, and of different sizes. Usually some remnants of renal structure are observed between the cysts, but this may have disappeared entirely. Generally also there is more or less increase in the connective tissue, but not always. The cysts are lined with epithelium. Their contents vary, the smaller ones containing a fluid holding urinary ingredients in solution, the larger ones an albuminous fluid; a colloid substance may also be found in some cysts. Occasionally the kidneys present a spongy or cavernous appearance on section, and the cysts are only visible on microscopic examination.

Associated with congenital cystic degeneration of the kidneys, there is in the large majority of cases found to be some malformation, variable in its nature, involving other parts of the urinary apparatus, namely, either of the calices and pelves, the ureters, the bladder, or the urethra. Other portions of the body may also give evidence of imperfect development, as indicated by cleft palate, absence or malformation of a limb, anencephalia, and allied conditions.

It mostly happens that those who are the subject of this disease are born prematurely, or, if the fœtus attains the full period, it is not viable, in consequence of the mechanical interference with the descent of the diaphragm caused by the enlarged kidneys, so that respiration cannot be initiated or carried on. In some cases embryotomy has had to be performed before delivery could be accomplished, in consequence of the large size of the abdo-

[1] Dublin Quarterly Journal, vol. xli. p. 438.

men of the fœtus. If the morbid condition has not proceeded far, the child may be born alive. It is a curious fact that cystic degeneration is sometimes observed in several children in succession, or alternately with healthy children, the mother being also quite healthy.

3. *Cystic Degeneration in Adults.*—This is a much rarer condition than the congenital disease. It probably originates in the same way, that is, from dilatation of the urinary tubules at intervals, and also of the Malpighian bodies. It is a question whether this affection is not merely a further development of a slight degree of the congenital form, which has gradually increased after birth. This may be the case in some instances: but in others the morbid condition seems to have commenced during extra-uterine life, and it has then been attributed to inflammation of the straight tubes in the pyramids, with consequent obliteration at intervals; or to plugging of these tubes by small coagula of blood. It has been regarded as being related to the small granular kidney. This disease has never been observed under thirty years of age, and most of the patients were between forty and fifty; it has been met with even above sixty. Men suffer twice as often as women. Its commencement has occasionally been apparently connected with injury over the renal region, and consequent hemorrhage into the kidney.

Cystic degeneration of the kidneys in adults always involves both organs, but usually unequally. They are enlarged and increased in weight, often enormously. In a case recorded by Dr. Hare[1] the left kidney measured 15½ inches in length, 9½ in breadth, and about 23 in circumference, and weighed 16 lbs. The right was only enlarged to about double its natural size. Bright[2] has described a case in which the left kidney was eight or ten times, and the right at least six times the natural size. In two cases brought forward by Dr. Whipham[3] the combined weights of both kidneys were respectively 81 ounces and 81¾ ounces. When the morbid change is advanced, the surface is always more or less irregular or lobulated, owing to the projection of cysts, and the kidney may have entirely lost its normal outline. On being cut into, it is seen to consist of an immense number of closed cysts, differing much in size, usually ranging from a pea to an apple, but some cysts may contain as much as a pint of fluid. The smaller cysts sometimes project into the larger ones, and they may communicate, owing to absorption of their contiguous walls. There is generally some renal tissue left, except in extreme cases; and the connective tissue is much increased in quantity. The contents of the cysts are usually liquid, clear, and yellowish or straw-colored. They may be red, purple, or chocolate-colored, from the presence of blood or altered blood. Sometimes they are opaque, inspissated, and semi-solid; or they may be of a gelatinous nature. The fluid is always albuminous, but does not contain urinous elements. Under the microscope, blood-corpuscles or their *débris*, cells from the renal tubules, pus-corpuscles, oil-globules and granules, crystals of triple phosphates, or uric acid, or abundant plates of cholesterine have been observed in different cases. The walls of the cysts are more or less thick according to their size; and they are lined by epithelium. Occasionally a cyst suppurates, and bursts into the renal pelvis. The urinary passages and bladder are perfectly free and open, and as a rule they are quite healthy.

Clinically cystic degeneration of the kidneys is not revealed by any characteristic phenomena during its earlier stages, its progress being very chronic and insidious. The disease may prove rapidly fatal from uræmia, when there have been no previous symptoms pointing to the kidneys. It would always be difficult to determine its existence with certainty during life; still, several cases have been diagnosed correctly, and the affection might be indicated by signs sufficiently characteristic. The condition as it advances necessarily interferes seriously with the renal functions, and especially with the excretion of the solid urinary ingredients. Occasionally pain is complained of in the loins, which may assume the character of recurrent and violent paroxysms. The urine does not seem to be diminished much in quantity, if at all, even until a late period, and it may be considerably in excess; but it is usually watery, and of low specific gravity. Albuminuria and recurrent hæmaturia are common, but not essential symptoms. The development of a renal tumor constitutes an important feature in the clinical history. This may be observed only on one side, and it may attain a large size, reaching even beyond the middle line; but most frequently an enlargement can be detected on both sides, and this may assist the diagnosis. The tumor may have an elongated form, and usually feels soft, but not fluctuating. Sometimes it presents a firm sensation, either over its whole extent or in parts. Patients suffering from cystic degeneration are often very emaciated and weak; sometimes œdema of the legs is observed. They are frequently troubled with dyspeptic and

[1] Pathological Transactions, vol. iii. p. 131.
[2] Abdominal Tumors, New Syd. Soc. Publications, vol. vi. p. 208.
[3] Pathological Transactions, vol. xxi. p. 244.

intestinal disturbances; while vomiting is sometimes a prominent symptom. Death is generally preceded by uræmic symptoms, such as mental confusion and delirium, coma, twitchings or convulsions, epileptiform fits, general paralysis, or violent hiccough. This event may, however, result from independent complications, such as bronchitis, which the renal condition will necessarily render more dangerous.

II. Malignant Growths—Carcinoma—Cancer.

Etiology and Pathology.—Cancer of the kidney is a comparatively rare form of disease, though not so uncommon as was formerly supposed. It may be either primary or secondary, and in the former case other structures are often subsequently involved. When it is primary, the cause of the development of the affection is generally quite undiscoverable, and it must be confessed that we are ignorant as to its origin. In some instances malignant disease has been attributed to injury over the loin, or to some direct irritation of the kidney, mechanical or chemical; but this is very doubtful, for even when there is a history of such an event, it may only accidentally have drawn attention to a previously existing condition, or if it be looked upon as the immediate cause of the cancer, there is no explanation why the disease should arise in one person and not in another. This can only be referred to a special constitutional state, but at the same time it is only in a small proportion of cases of primary malignant disease of the kidney that any hereditary predisposition has been traced. Even in the case of young children there is no family history of cancer, and other children of the same family are quite healthy. Age exercises a remarkable influence as regards the frequency of this affection. Formerly it was regarded, like other forms of cancer, as a disease almost confined to persons advanced in years. More recent observations have, however, revealed the fact that a large proportion of cases are met with among very young children. Of sixty-seven cases collected by Dr. William Roberts,[1] twenty-five occurred in children under ten years of age, of whom twenty-two were under five years. Dr. Braidwood[2] describes four cases which came under his notice in children under two years of age, in one instance the disease having been first observed when the child was four months old, death occurring at eight months. One of these cases the writer had an opportunity of seeing during life. The disease is very rarely met with from ten to twenty years of age, but is not proportionately uncommon in young adults, though it becomes more frequent from fifty to seventy. Males suffer much more frequently than females from renal cancer; but this difference is observed to a far greater degree in adults than in children.

Secondary cancer of the kidney may result from direct extension from some neighboring structure; or as a development of a general carcinomatous diathesis, this organ being implicated along with, but at a subsequent period to, others, which have been the primary seat of the disease.

With regard to the pathology of true renal cancer, it is not yet satisfactorily settled from what tissues the elements which constitute the growth originate. It was formerly generally supposed, and is still held by some pathologists, that they were developed from the cellular tissue of the kidney. Braidwood believes that the cancerous alteration commences in the cellular tissue surrounding the Malpighian corpuscles. More recently, however, the cancer cells have been traced to the epithelium lining the urinary tubules, from the proliferation of which they are supposed to be derived. The stroma consists of the walls of the tubules and the intertubular connective tissue, which afterwards becomes increased in some cases. It must be noticed, however, that in some instances, which are apparently those of renal cancer, it is probable that the disease has not really commenced in the actual substance of the kidney, but in its hilus, spreading thence into the organ. Wilks,[1] indeed, thinks that this is the commonest plan of attack in primary renal cancer, and observes: "It is remarkable how seldom the proper tissue of the kidney can be said to be primarily affected; for although a large tumor may exist, and this after death be removed as renal cancer, yet a careful dissection discovers the disease to have arisen primarily in the lymphatic glands, or other parts outside of the kidney, especially about its hilus, while the organ itself is comparatively untouched; the disease, however, puts on the form of the kidney, for it has probably penetrated the hilus and expanded the capsule." Zencker and Karl Schroeder have also drawn attention to a similar mode of origin in cases of supposed primary renal cancer, the growth being termed "paranephritic," and the latter observer believes that such growths originate in the

[1] On Urinary and Renal Diseases, 3d edit. p. 525.

[2] Liverpool Med. and Surg. Reports, vol. iv. p. 45.

[1] Pathological Anatomy, 2d edit. p. 518.

endothelium of the bloodvessels. It is highly probable that this view of the origin of renal cancer is correct in many instances.

Anatomical Characters.—Primary renal cancer is one-sided in the great majority of cases, but there is a difference of statement as to which organ is most frequently attacked. Out of sixty-seven instances collected by Dr. William Roberts,[1] sixty were unilateral cases, and each kidney was affected an equal number of times. In fifty-nine cases collected by Ebstein,[2] thirty-one involved the right, twenty-three the left, and five both kidneys. Encephaloid or medullary cancer is the variety met with in all but exceptional instances, though Waldeyer has designated many cases as simple carcinoma, and ranks them as intermediate between scirrhus and encephaloid. Well-marked scirrhus is very rare; occasionally masses have been found in the midst of medullary cancer. Colloid cancer has been observed in exceptional instances; or portions of other malignant growths have undergone colloid degeneration. Robin has given a description of one case of supposed epithelioma. Klebs has described growths presenting transitions from cancer to adenoma; and other tumors of a mixed character have also been described, consisting of carcinoma, sarcoma, and adenoma. Melanotic growths have been observed in the kidney, but it is doubtful whether most of these were of a cancerous nature. Faggé[3] has, however, recorded a case in which such growths were found in the kidneys along with other organs, and spots of pigment in the lining membrane of the pelvis. The same observer[4] has brought forward an instance of what he believed to be carcinoma lipomatosum, which occupied the whole centre of the right kidney, and grew freely into the renal vein and its branches. This growth presented the characteristic alveolar structure of a carcinoma, and the fat-globules were contained in the interior of cells of very irregular forms, with large oval nuclei.

For practical purposes it will be sufficient to describe the anatomical characters which cancer of the kidney ordinarily presents, and it may certainly be regarded as belonging more or less distinctly to the encephaloid variety. The morbid growth is either infiltrated uniformly throughout the organ, or assumes a nodular form. The kidney is almost always enlarged to a variable degree, and increased in weight. It may assume enormous dimensions, and reach several pounds in weight, often growing with great rapidity; and it is remarkable that the largest and heaviest specimens have been observed in children. Dr. William Roberts[1] found that in the cases collected by him where information was given as to the weight, in children it averaged 8½ lbs., the smallest being 1 lb. 9 ozs., the largest 31 lbs.; in adults the average weight was 9½ lbs., but in one case the size and weight were about normal, and the highest weight recorded was 27 lbs. The shape of the kidney depends on the mode in which the cancer is distributed in the organ. If the growth is infiltrated, the outline may be but little or not at all altered, only that the organ seems more rounded than usual; if it is nodular, then the kidney becomes more or less irregular in form, and presents prominences of various sizes upon its surface, giving it a lobulated appearance. Sometimes the growth projects from one point of the organ, and then the irregularity is still more evident. The color is frequently altered from that of the normal kidney. The consistence varies, and is often unequal; some of the nodules may feel firm, but usually they are more or less soft, and sometimes present a sensation of quasi-fluctuation.

A section of a cancerous kidney presents different appearances according to the extent to which the change has advanced, the mode of arrangement of the growth, the variety to which it belongs, its degree of vascularity, and the alterations it may have undergone, and to the condition of the renal tissue, should any remain. The cortical portion is first implicated, and then the disease extends into the medullary portion. If it is in the infiltrated form, the whole section may present a uniform yellowish or whitish appearance. When the arrangement is nodular, nodules presenting this color may be seen in the midst of the kidney structure, from which they are sometimes separated by distinct capsules of condensed cellular tissue. The uninvolved renal tissues may be healthy, congested, atrophied and the seat of degeneration, or inflamed and even suppurating. In many cases, however, the separate growths have coalesced, and have thus entirely destroyed these tissues. Again, they may present different degrees of vascularity, in some instances resembling the so-called "fungus hæmatodes;" while the numerous delicate vessels are liable to give way, being also sometimes the seat of minute aneurisms, so that extra-

[1] On Urinary and Renal Diseases, 3d edit. p. 524.

[2] Ziemssen's Cyclopædia of Medicine, vol. xv. p. 662.

[3] Pathological Transactions, vol. xxviii. p. 173.

[4] Ibid. vol. xxvii. p. 204.

[1] Urinary and Renal Disease, 3d edit. p. 523.

vasations of blood not uncommonly occur, which may be very considerable, as much as a pint of blood having been found in a cavity in the midst of a cancerous kidney. Moreover, the appearance and characters of the cancerous tissue may be varied by the occurrence of softening, fatty degeneration, the formation of cysts, or of abscess-like cavities. The consistence is said generally to be about that of human brain, but this is also variable, and the material may be quite pulpy.

Most commonly cancer of the kidney projects into the pelvis of this organ, and its walls may be involved. Blood is also liable to be extravasated here, and the clot may assume a stratified arrangement. The pelvis is sometimes distended or distorted. The ureter is often occupied more or less by an extension of the cancerous growth, and its channel may be thus completely closed, or its walls may be implicated. This tube is also liable to be obstructed by blood-clots, or as the result of pressure upon it by the renal tumor. Calculi are found sometimes in the pelvis of a cancerous kidney. The renal vein is frequently involved in the disease, being first surrounded and compressed, then its walls are destroyed, and the growth gradually fills its channel, and may thence spread directly into the vena cava inferior, or even beyond this vessel.

A cancerous kidney usually remains in its normal position, and becomes united to surrounding structures by firm and extensive adhesions, its capsule being also thickened and often highly vascular. Occasionally the organ is displaced, and it may be free and movable. As it enlarges it produces various effects upon neighboring organs, either displacing, compressing, or perforating and destroying them, or they become involved by extension of the morbid process. The colon always lies in front of the growth, but is often compressed, and may be quite flattened and collapsed. Among the conditions which have been observed in exceptional instances are compression of the duodenum, with consequent dilatation of the stomach; perforation of the duodenum; erosion of the vertebræ; and perforation of the abdominal wall. The vena cava inferior is liable to be pressed upon more or less, and anasarca of the lower extremities results; ascites is only rarely observed. When the growth becomes of considerable size, it interferes with the diaphragm, pushing it upwards, along with the thoracic organs.

In more than half the cases of primary renal cancer, secondary formations have been observed. The structures most commonly thus implicated are the absorbent glands in the hilus of the kidney, those lying on the vertebræ, and the mesenteric glands. Very large tumors may be found in connection with these structures. Next in order come the lungs and liver, but other organs or structures are much less frequently involved. It is a remarkable fact that the bladder and lower urinary passages are extremely rarely affected secondarily in cases of cancer of the kidney.

In unilateral renal cancer, the unaffected organ is generally hypertrophied, and thus does double duty; in rare instances it becomes the seat of amyloid degeneration.

Secondary cancer is not uncommon in the kidneys, and when the condition is a manifestation of a general cachexia, both organs are usually involved. The carcinoma exists in the form of scattered nodules, which may range from not larger than a pin's head to the size of a walnut. The organs are not enlarged, and their shape is not altered. The intervening renal tissue is quite healthy.

Symptomatology.—Renal cancer may be latent throughout its course, giving rise to no symptoms or signs whatever. This is observed in almost all cases of secondary cancer, which is generally only discovered at the post-mortem examination, but only very rarely happens when the disease is primary. The local clinical phenomena to which it will be necessary to call attention as more or less significant of cancer of the kidney, are pain in the renal region, hæmaturia, and the development of a tumor. In addition to these, there are frequently symptoms due to the interference by the growth with neighboring structures; and others connected with the general system.

Pain is an uncertain symptom in cases of renal cancer. Its absence or insignificant character has been often noted throughout or for a considerable time, even when the tumor has attained a large size. On the other hand, marked pain may be complained of from an early period, and although its absence by no means excludes cancer of the kidney, its presence along with a tumor and hæmaturia is of importance in making a positive diagnosis. It may be experienced, too, before the other more characteristic signs of the disease are observed, and may thus be the means of drawing attention to this serious condition, by leading to a careful investigation of the case. The pain is referred mainly to the lumbar and hypochondriac regions on one side, but is liable to shoot along the lower intercostal spaces, or downwards towards the inner side of the thigh or along its posterior aspect, in the latter case resembling sciatica, and there is then a danger of the suffering being attributed to mere neuralgia, should there be no other prominent symptoms. In character the pain may

be constant, dull, and aching, or intermittent, and it is often aggravated paroxysmally, sometimes becoming intense at intervals. There is no retraction of the testis. Tenderness is usually observed when there is spontaneous pain in connection with a tumor, and in some cases the pain is only felt on manipulation or pressure over the renal region, when it may also sometimes be caused to shoot into other parts. When a cancerous kidney assumes large dimensions, its mere bulk will probably give rise to sensations of more or less discomfort, pressure, or tension. It must also be borne in mind that attacks of true renal colic may occur in cases of this disease, owing to the passage either of calculi or of blood-clots from the pelvis of the kidney to the bladder.

Hæmaturia is a symptom of much importance in many cases of cancer of the kidney, but it was absent in rather less than half of the recorded cases, and it may only be observed at the outset of disease, subsequently disappearing, or towards its close. This is accounted for either by the fact that no hemorrhage has taken place; or that the blood has been prevented from escaping, in consequence of the obstruction of the ureter by a clot or by cancerous matter, or of its compression by the tumor. Occasionally also it is due to some other cause than the carcinoma, such as a calculus. In not a few instances hæmaturia has for some time been the only symptom of malignant disease, and exceptionally there has been no other symptom throughout; if it should occur spontaneously, without any pain or other symptom of calculus, the blood evidently coming from the kidney, this disease should be suspected and watched for. Sometimes the first appearance of blood in the urine is traceable to some external violence over the loin; and this has even drawn attention to the existence of a tumor in this region. The chief characters of hæmaturia occurring in connection with renal cancer, which may be regarded as more or less significant, are, that it comes on spontaneously and without any obvious cause; that it takes place at irregular intervals, lasting a variable time; that the blood is in considerable quantity; and that there is no pain accompanying its discharge. The urine almost always affords distinct evidence of the presence of blood, and the discharge is not uncommonly very profuse, though rarely so excessive as to lead to general anæmia and faintness. The blood is mostly intimately mixed with the urine, but sometimes clots form, and these, during their passage, are liable to give rise to certain disturbances, especially to symptoms of renal colic during their transit along the ureter, when they may also interfere with the further escape of blood, the urine becoming quite clear; and to irritability of the bladder, accompanied with retention of urine and much suffering, from the impaction of a clot in the neck of the bladder or in the urethra. When examined microscopically the urine presents blood-corpuscles, some of which may be altered in appearance, and often blood-casts are visible.

The development of a tumor is the most frequent clinical phenomenon in cases of primary renal cancer, a distinct enlargement, readily discovered on examination, having been observed in all but exceptional instances. It first appears in the lumbar region, in the interval between the margin of the thorax and the iliac crest, but is usually more evident towards the front of this region than towards the back, because the growth meets with more resistance in the latter direction. The tumor increases sometimes with great rapidity, especially in children, extending chiefly forwards into the umbilical region, and downwards into the iliac region and towards the pubis. The size it may ultimately attain varies much, but it sometimes completely fills the abdomen, causing great general enlargement of this part of the body, particularly in children. When the growth becomes large, the superficial veins over it may be distended. When it has not exceeded moderate limits, palpation reveals that it has rounded margins, and its surface is either smooth or irregularly nodulated and lobulated. The consistence is variable, but generally the sensation afforded is one of more or less elasticity, and sometimes of quasi-fluctuation; not uncommonly different parts of the tumor yield sensations of different degrees of firmness, especially when it is lobulated. A cancerous kidney is almost always remarkably immovable, on account of the adhesions which form, so that it is not affected by the deepest inspiration, or by manipulation. At the same time, when the tumor projects anteriorly, and its connection with the kidney is not very evident, firm pressure upon it with one hand from the front in a backward direction, while the other hand is placed behind, may push it back somewhat, and show that it belongs to this organ. In exceptional instances also the tumor is not fixed, and a floating kidney may become the seat of cancer.

Percussion yields a dull sound over the greater part of the tumor in cases of renal cancer, but in front an intestinal note is usually elicited, owing to the colon lying in front of it, and on the left side not uncommonly a portion of the small intestines occupies the same position. Sometimes the colon is compressed, however, and then there is dulness also in front; but the intestine may then possibly be felt as

a band lying upon the growth. It has been suggested that in this case the gut might be blown up by injecting air per rectum. The opposite side of the abdomen is generally tympanitic, in consequence of the mass of the small intestines being pushed over by the tumor, provided it has not become so large as to fill the abdominal cavity. A sensation of more or less resistance is experienced on percussion. In exceptional instances renal cancer has distinctly pulsated; and still more rarely a blowing murmur has been heard on auscultation. Holmes[1] has recorded a case in which both pulsation and a bruit were present.

The urine, apart from the presence of blood in it, does not present any special changes in cases of renal cancer. Sometimes the quantity is increased or diminished, and the nitrogenous elements may be in excess. Albuminuria and pyuria have been occasionally observed, depending, however, upon other conditions than the malignant disease. There has been much discussion as to whether cancer-elements are ever found in the urine. The balance of evidence is certainly against the detection of any microscopic elements characteristic of cancer, and cells which have been supposed to have come from such a growth, have probably been merely epithelium particles detached from the renal pelvis and ureter.

The symptoms which may result in cases of renal cancer from the interference of the tumor with neighboring structures are variable. The bowels may be much constipated or even obstructed; occasionally there is diarrhœa. Gastric symptoms are not uncommon, such as loss of appetite, dyspepsia, nausea, or vomiting, but the appetite may be retained to the last, and is sometimes excessive. Local œdema or anasarca of the legs, with enlargement of superficial veins, may be observed as a consequence of pressure on large veins. In rare instances jaundice has occurred from obstruction of the common bile-duct.

The general system is usually gravely affected, as evidenced by rapid emaciation, which may become extreme, progressive debility and exhaustion, anæmia, constitutional irritation and restlessness, and a yellowish tint of skin. In some instances, however, general symptoms have not appeared for a considerable time. The pulse is sometimes unusually slow, and the temperature below the normal. Febrile complications occasionally occur towards the end. Symptoms may arise indicating secondary development of cancer in other organs.

The duration of cases of renal cancer varies widely, but it is shorter in children than in adults. Dr. William Roberts[1] found that in children the average duration was nearly seven months, the extremes being ten weeks to "over a year;" in adults the average was two and a half years, the extremes five months to seven years. Death usually results from gradual exhaustion, but it has also taken place from rupture of the cancerous kidney. Uræmic symptoms have never been observed in cases of this disease.

III. Non-malignant or Benign Growths.

Non-malignant growths are only very rarely found in the kidney, and they are of but little clinical significance. A brief account of these growths will therefore suffice.

1. Sarcomata have been observed in several instances, but usually as secondary formations, being then evidently malignant. In rare cases a primary growth is of this nature, presenting on microscopic examination a spindle-celled or round-celled structure. It is doubtful whether such a growth should be regarded as malignant or benign. It is usually of small size, but may attain such dimensions as to be recognizable as a tumor during life.

2. Fibromata are generally observed in the form of small nodules or knots, situated near or in the pyramidal portion, either in kidneys which are otherwise healthy, or in those which are granular and contracted. They do not give rise to any symptoms. They are very dense, and are composed of firm fibrous tissue, sometimes enclosing the remains of renal tubules. Wilks[2] has recorded a case in which the right kidney was converted into a tumor of the size of a young child's head. This consisted of a large fibrous growth, which had invaded and destroyed the whole structure; and of a cyst, which was the distended pelvis. The general form of the kidney was preserved. The new growth was remarkably hard, and resembled a fibro-cartilaginous tumor in appearance; but microscopic examination showed that it consisted entirely of fibrous tissue. Its centre was breaking up, so that a rugged cavity existed in the middle. In this case hæmaturia and pain in the loins had existed for ten years, and a tumor formed six years before death, which gradually increased. The health did not suffer much, and death was preceded by symptoms of a uræmic character. The patient was a male, aged fifty-three.

[1] Pathological Transactions, vol. xxiv. p. 149.

[1] Urinary and Renal Diseases, 3d edit. p. 530.

[2] Pathological Transactions, vol. xx. p. 224.

3. Lipomata or fatty growths are sometimes found in connection with the kidney. They seem to commence generally around the organ, and to extend into its interior, affecting its nutrition, and leading to atrophy of its tissues. Ultimately a large portion, or even the whole, of the kidney may be converted into a mass of fat. Probably this condition in some instances follows atrophy of the kidney, and it has been found associated with calculi. Cases have been recorded in which tumors of large size were composed chiefly of fat in a matrix of fibrous tissue. Allusion has already been made under Cancer to a fatty growth observed by Fagge, and regarded by him as being of a malignant nature.

4. Without entering into any description, it will be sufficient to indicate what other forms of growth have been occasionally found in the kidney. Adenoid or lymphatic deposits are sometimes seen in certain cases of leucocythæmia and allied disorders. This tissue may even form actively growing tumors. Dr. Whipham[1] has recorded a case in which the kidneys were the seat of lymphadenoma, their surface being everywhere studded with small elevations, situated immediately beneath the capsule, and resembling to the naked eye extravasations of blood. Microscopic examination revealed that they were of a lymphadenomatous nature. Villous growths have been very rarely met with in the kidneys. Murchison[2] has recorded a case in which the mucous lining of the pelvis and calices of both organs presented numerous long villous processes, associated with a similar condition in the bladder. De Morgan[3] also described a case of a distinct villous tumor projecting from the wall of the pelvis of the left kidney. Part of the growth was compact, and consisted of a delicate fibrous stroma, from which a juice containing nucleated cells exuded. He regarded it as non-malignant. Other villi sprang from various parts of the walls of the pelvis. These growths may give rise to considerable hemorrhage. Cavernous angioma is now and then observed in the kidney, usually near the surface. Gliomata occur as small tumors in the cortical portion, which may reach the size of a cherry, are very soft and tender, white and translucent, and deficient in blood. Lastly, cartilaginous and osseous tumors have been found in the kidneys, the latter resulting from the ossification of fibrous or other growths. Occasionally the capsule becomes ossified, forming a kind of shell.

[1] Pathological Transactions, vol. xxiii. p. 166.

[2] Ibid. vol. xxi. p. 210.

[3] Ibid. p. 239.

IV. Tubercular Disease—Nephrophthisis.

Etiology and Pathology.—Cases which have been regarded as belonging to the class of tubercular diseases of the kidneys are referable to three groups, which it is necessary to distinguish, namely:—1. Those in which so-called tubercle is formed primarily in the kidney or its appendages, and gives rise to prominent urinary symptoms. 2. Those in which the formation of tubercle is a manifestation of acute tuberculosis, the urinary organs being implicated along with other structures. 3. Those in which the disease occurs as a secondary event in the course of pulmonary or other form of phthisis, the renal condition being of the nature of a complication.

The primary form of the affection is by no means common. The writer has only met with two cases which were apparently of this nature, during an experience of several years among the out-patients at the Brompton Hospital for Consumption. The true pathology of the disease is anything but settled. By many authorities it is regarded as a primitive tuberculosis—a manifestation of a constitutional condition—hence termed *primary renal phthisis*, *scrofulous* or *strumous inflammation*, and as analogous to the tubercular form of pulmonary phthisis. Other pathologists, with whom the writer is to some extent inclined to agree, are of opinion that the disease originates in inflammation, at any rate in many cases, the products undergoing a caseous or cheesy degeneration, but true tubercle often forms secondarily. Unquestionably in many instances there is no history of any hereditary tendency to phthisis. The affection has been in some cases attributed to cold, but this mode of causation is very doubtful, and it must be granted that generally the cause cannot be traced. The morbid condition in the kidneys is in some instances really secondary, and not actually primary, following cheesy or caseous inflammation either in the bladder, the testicle, epididymis, or the prostate gland; and it may originate by direct extension, or as a distinct and separate lesion, being then probably due to an infective process. It is remarkable that while the generative organs are frequently involved along with the kidneys in males, this is very rarely the case in females. Males are nearly twice as often affected with renal phthisis as females; in both the cases observed by the writer the patients were males. The disease is most common about the middle period of life, but has been noticed as early as three and a half, and as late as seventy-one years of age.

The etiology of secondary tubercular disease of the kidneys needs but little comment. As already indicated, it may be a mere local development of a general constitutional diathesis; or it arises as a complication of some previously-existing complaint, either in the lungs or elsewhere, which is usually recognized as being of a phthisical nature.

Anatomical Characters.—In primary renal phthisis it is usually found that not only is the kidney and its pelvis involved, but almost invariably the disease also implicates the ureter, in a large proportion of cases the bladder, and sometimes the urethra. Originally probably only one organ is affected, but as the case progresses the other organ is often attacked, so that in the majority of instances examined post-mortem both kidneys have been found diseased, though usually to an unequal degree. The kidney itself may be first affected; or its pelvis, the lesion then spreading upwards to the kidney and downwards along the ureter; or the bladder or generative apparatus; or, occasionally, all the parts seem to be implicated almost at the same time, or in rapid succession. As a rule the morbid changes are seen in an advanced stage, but it will be requisite to point out briefly the course through which they pass.

When the disease starts in the body of the kidney, it is generally stated to begin in the cortical substance, and subsequently to extend into the pyramids; but Wilks thinks that the pyramids are earliest affected. At the outset gray nodules are said to form, but these rapidly become yellow and caseous, also coalescing to form extensive infiltrations, until finally the greater part, or occasionally even the whole of the organ is involved, its tissues being destroyed. Around these infiltrations miliary tubercles often appear. The cheesy masses soften in the centre, and come to resemble abscesses, which burst and discharge their contents into the renal pelvis. Thus irregular cavities, vomicæ, or ulcers are formed, having soft and cheesy walls, and from which a purulent fluid is discharged, mixed with caseous *débris*. Ultimately the entire organ may be destroyed in this way. In the pelvis and ureter the morbid formation commences in the submucous tissue, as an irregular granular layer, semi-transparent at first, but soon becoming opaque and caseous. This also softens, and the overlying mucous membrane becoming thickened and ultimately destroyed, the disintegrated materials are removed, and irregular ulcers of variable extent are formed in the pelvis—the so-called *tubercular ulcers*—from which pus, blood, cheesy *débris*, and shreds of tissues escape. After a time other parts of the mucus membrane become thickened, discolored, or covered with scrofulous deposits. This is the condition known as *tubercular* or *strumous pyelitis*. In rare instances thick calcareous deposits form. In some cases the ureter becomes almost completely closed up, either on account of infiltration of its walls, so that it forms a rigid tube, or from blocking-up of its canal by caseous masses or *débris*. Under these circumstances the escape of the pus and other materials from the renal pelvis is prevented, and pyonephrosis results. Then the kidney is involved, being either compressed by the accumulated fluids, or becoming the seat of the changes already described.

The exact appearances presented by kidneys and their appendages which are the seat of renal phthisis, necessarily vary considerably. The affected organ is commonly enlarged, either from the amount of the infiltration or from pyonephrosis; it may, however, be of normal size, or in exceptional cases is rather small. It is sometimes nodular at the surface; and its capsule is not uncommonly thickened and may be very firm, or it presents caseous patches upon its surface. Usually portions of the renal structure remain, which are either fairly healthy or in a state of disease. In extreme cases, however, the whole kidney is destroyed, nothing being left but a sacculated cavity, containing pus and other products. Occasionally these become inspissated, and the sac shrinks to a small size, a cure practically resulting under these circumstances. In rare instances the purulent collection has been known to burst in one or other of the directions already indicated in the article on Renal Abscess.

The bladder is frequently found to be the seat of tubercular disease, along with the renal apparatus, and in some cases the urethra is involved. The prostate gland, vesiculæ seminales, or testicles are also affected in a certain proportion of cases. The female generative organs are only very exceptionally implicated. In almost all cases secondary tuberculous disease will be found in some other organ or structure, especially in the lungs, in the intestines, or in the absorbent glands within the abdomen.

When tubercle in the kidney is a part of general tuberculosis, or is secondary to disease elsewhere, it assumes the form of small miliary granulations, either rounded or somewhat elongated, or linear if seated in the medullary portion, and often surrounded with a circle of excessive vascularity. These granulations form in the interstitial tissues, and consist of lymphoid cells. At first they are gray, but rapidly undergo caseation and become yellow. The granulations are chiefly ob-

served towards the surface and in the cortical substance, and they are either scattered and distinct, or aggregated into groups. Both kidneys are almost always involved, but the pelves and ureters are not affected usually.

Symptomatology.—When tubercle in the kidney is a part of general tuberculosis, or occurs as a complication of phthisis, it is only in exceptional cases that there are any symptoms present calling attention to this organ. When it arises in the course of phthisis, possibly the condition might be indicated by severe pains in the loins, with much tenderness, contraction of the lumbar muscles, and disordered renal functions, as in a case recorded by Colin.

Primary renal phthisis is usually characterized by prominent symptoms, but they may not appear for some time after the disease has commenced. It must be remembered also that the symptoms connected with the urinary organs are not uncommonly modified by the association of vesical or other mischief along with the renal affection. Pain in the lumbar region is present in the large majority of cases, and is not infrequently one of the first symptoms. It varies much in intensity, as well as in its characters, but seems in most instances to be dull and continuous, though it may occur in sharp paroxysms. It rarely shoots towards the thigh. Should the ureter become blocked, exacerbations of pain are liable to follow. Tenderness is also observed, and it may be present without any spontaneous pain. Micturition usually becomes very frequent, and there may be an almost constant desire to pass water, accompanied with straining, but little relief following the act, though this occasionally decidedly alleviates the pain and discomfort. Sometimes incontinence is observed. Pain or burning is often experienced during the passage of the urine. The disorders of micturition are generally more prominent when the bladder and urethra are involved, but these parts may be quite healthy, the symptoms being then traceable chiefly to the condition of the urine. This excretion presents striking characters, which are readily understood when the pathological changes observed in renal phthisis are borne in mind. It becomes almost always diminished in quantity as the disease progresses, though in exceptional cases it is in excess. The reaction remains faintly acid, provided that the bladder is not involved, or that the urine is not retained in the renal pelvis, when it tends to become alkaline and ammoniacal. Hæmaturia is usually observed at some period of the disease, but the blood is never passed in any considerable quantity. This may be one of the first symptoms noticed, and the blood may afterwards disappear. Small, thready clots are passed not uncommonly. One of the most striking characters presented by the urine is its admixture with pus, due chiefly to tuberculous pyelitis. At first the pus only causes slight turbidity, but afterwards it becomes abundant, so that it falls as a more or less copious deposit when the urine is allowed to stand. If the urine should become ammoniacal, the presence of the pus would cause it to become viscid and ropy, so much so that it might even be difficult to pass it. Albuminuria exists in proportion to the amount of pus discharged; and in rare instances this symptom has been observed very early, independently of the pressure of pus. Much stress has been laid, as significant of tubercular disease of the kidney, upon the presence in the urine of particles of caseous matter, which may be visible to the naked eye, and which are insoluble in acetic acid. Microscopic examination reveals in different cases and at different times blood-corpuscles; normal and altered pus-cells; epithelium cells from the urinary passages and bladder, often modified; granular detritus; and fibres of connective and elastic tissues, these being considered by some observers as highly significant.

Should the ureter become obstructed in any way, the clinical course of events will be similar to what has been described in former articles, namely, the clearing-up or diminished turbidity of the urine, and the development of a renal fulness or enlargement, which may exhibit fluctuation. This rarely attains any great size, and is often difficult to demonstrate; but it has been known to extend beyond the middle line of the abdomen. The fulness is generally painful and tender. It may vary in size and in the accompanying sensations from time to time.

Tubercular disease of the kidney is soon accompanied with general symptoms, which become more and more marked as the complaint progresses. These are pyrexia, often of a somewhat intermittent character, with regular chills or rigors, the fever in time assuming a hectic type, with night-sweats; general wasting, which may amount to extreme emaciation; anæmia; and debility. The digestive functions are also disturbed in most cases, and nausea and vomiting are not uncommon symptoms. As the disease advances, signs of implication of the lungs, intestines, or other organs are developed. Diarrhœa very frequently occurs. In rare instances a purulent accumulation may burst in some direction, and give rise to corresponding clinical phenomena. Possibly, if only one kidney is involved, a curative process may take place, and the patient recover. Almost

always, however, the termination is fatal, and in most cases death has occurred within twelve months from the first appearance of symptoms, but the duration may be prolonged to two or three years. Death generally takes place from gradual exhaustion, aided by complications. If both kidneys are destroyed, uræmic phenomena may supervene at last. The rupture of a purulent accumulation may be the cause of the fatal termination in exceptional cases.

V. Syphilitic Disease.

The morbid condition of the kidney which is usually associated with syphilis is albuminoid disease, the connection between the two being not infrequent. This lesion is discussed elsewhere, and need not be further considered here. The development of gummata in the kidney is exceedingly rare. Among the specimens exhibited at the Pathological Society during the discussion on Visceral Syphilis in 1877 (see Pathological Transactions, vol. xxviii.), there was only one of a gummatous growth in this organ. Even when present these gummata are usually very small, often not larger than a pea. The largest observed seems to have been in a case recorded by Dr. Moxon.[1] In the left kidney of a woman, which was the seat of albuminoid disease, a gummous tumor as large as a small potato was found. It presented a uniform, yellowish-white appearance, and was firm, tough, and dry. Microscopic examination showed that the growth consisted of small corpuscles crowded together, which gradually broke down into fat granules and globules, the renal tissue being destroyed and replaced. Other growths of this kind have presented similar characters. Ultimately they may be completely destroyed and removed, the kidney then presenting scar-like depressions.

The formation of syphilitic gummata in the kidney is not attended with any symptoms, and they have always been discovered at post-mortem examinations. Albuminoid disease occurring in connection with syphilis presents the same clinical history as when it arises from other causes.

VI. Parasitic Formations.

The following so-called animal parasites have been found in connection with the renal apparatus:—1. Hydatids, with Echinococcus hominis. 2. Cysticercus cellulosus. 3. Strongylus or Eustrongylus gigas. 4. Bilharzia hæmatobia. 5. Filaria sanguinis hominis, a minute nematoid worm, discovered by Dr. T. R. Lewis, associated with chylous urine. 6. Pentastoma denticulatum, a minute encysted parasite, only observed once, and supposed to be the larva of the pentastoma tænioides. In addition to these, intestinal worms occasionally make their way into the urinary organs. Only the most important of these parasites are to be considered here.

1. Hydatid Disease—Echinococcus Hominis.

It is unnecessary to enter in this connection into a general discussion of the natural history, etiology, and morbid anatomy of hydatid disease, as these matters are fully considered in the article on Hydatids of the Liver (*ante*). It will be sufficient to draw attention to the main facts bearing upon the relation of this disease to the kidney.

Etiology.—The kidney stands third in the order of organs affected with hydatid disease, being much less frequently implicated than the liver, and also somewhat less commonly than the lungs. In exceptional cases other organs are involved at the same time; but usually the disease is confined to the kidneys. It occurs chiefly during middle life, but has been met with at the extremes of age. Males seem to be more often attacked than females in some places, probably because they are more exposed to the causes which lead to the introduction of the parasite into the system. In Iceland, however, this difference is not observed.

Anatomical Characters.—Hydatid disease is almost always confined to one kidney, and the left is more frequently involved than the right. A cystic tumor is formed, which varies in size from that of an egg to that of an adult head, and it may project from the surface of the organ as a roundish prominence, elastic or fluctuating. Much will depend upon its situation. Usually the growth forms in the substance of the kidney, but sometimes it lies underneath the capsule, between this and the surface of the organ. When situated here or in the cortical substance, the cyst may attain a large size; if it occupies the pyramids, it usually bursts before it reaches any great dimensions. On examination the tumor is generally found to consist of the usual constituents of a hydatid growth, namely, an external fibrous capsule, lined by the laminated hydatid-cyst, this again being lined by a delicate germinal membrane, upon which scolices of echinococci are visible. The

[1] Guy's Hospital Reports, 1868.

cyst contains a saline non-albuminous fluid, in which float secondary or daughter-cysts, and these in rare instances inclose tertiary cysts. Sometimes the structure is more simple, and there may be no secondary cysts or echinococci, this condition constituting the so-called acephalocyst. The fluid occasionally contains crystals of uric acid, oxalate of lime, and triple phosphates.

The effect of the hydatid-cysts upon the renal tissue is to cause it to waste more or less in proportion to the size of the tumor, and the kidney structure may ultimately entirely disappear, though usually some remains. The interstitial connective tissue is generally increased; and the growth often forms extensive adhesions with the parts around. The surrounding organs are more or less compressed and displaced if the cyst attains any considerable size.

The pathological sequence of events varies in different cases of hydatid disease of the kidney. The cyst may remain unchanged, or be opened artificially. In a very large proportion it ruptures into the renal pelvis, and especially if it occupies the pyramidal portion of the organ. Pyelitis may then be set up, and the small secondary cysts are conveyed away by the ureter. The cyst has been known in exceptional instances to open into the intestines, stomach, or lungs and bronchi, in the last case its contents being expectorated, but never into the peritoneal cavity. It may open in more than one direction. The rupture may either occur spontaneously, or as the consequence of some external violence over the seat of the tumor. The cyst has occasionally suppurated, or has excited surrounding inflammation, terminating in the formation of an abscess, with which it has subsequently communicated. After it has ruptured, or now and then even without this event having taken place, it may become obsolescent or atrophied, its fluid contents being absorbed, and the sac shrivelling up into a more or less firm mass, consisting of a whitish, greasy, sebaceous-looking, or chalky material, which, on examination with the microscope, is found to be made up of fatty granules and globules, cholesterine, amorphous and crystalline phosphates, in which are embedded shreds of laminated membrane and hooklets of echinococci.

Occasionally renal calculus has been found associated with hydatid disease. In one recorded case one kidney was congenitally absent, and the other was the seat of a large calculus and of a hydatid-cyst. In the Pathological Transactions, vol. xxv. p. 174, an interesting case is described by Dr. Cayley and Dr. Woodman, of an infant in whom there was a multilocular cystic tumor, supposed to be a cystic form of hydronephrosis, combined with a true hydatid-cyst. Another case is also alluded to in the same communication where such a cyst was associated with encephaloid cancer.

Symptomatology.—It need scarcely be remarked that hydatid disease of the kidney may be latent throughout, the condition being only discovered after death. In most cases no symptoms are observed for a considerable time, and the only phenomena which can be regarded as at all characteristic are, (1) the development of a renal tumor presenting certain characters; and (2) the passage of hydatid-vesicles or their structural elements, and their escape through the urethra with the urine. Various symptoms may arise from the events which are liable to occur in connection with the tumor.

A tumor has been observed in about half the cases. It is almost invariably unilateral, and occupies the ordinary situation of a renal tumor, being as a rule confined within such limits that it can be recognized as belonging to the kidney. The growth is slow and gradual in its progress. Generally the tumor is painless and not tender; but if it becomes very large, it gives rise to a sense of discomfort, weight, or tension. On manipulation it feels smooth and rounded, and often tightly distended. Fluctuation is readily detected in some cases; in others it is indistinct, or there is only a sensation of elasticity. Hydatid-fremitus is a most important sign when present, and a sound of a similar character may occasionally be heard by auscultation on tapping gently over the tumor. Unfortunately, however, these signs are only elicited in a small proportion of cases, and they may be absent apparently even when the conditions exist which are regarded as most favorable for their production. Percussion usually reveals that the colon lies in front of the tumor, but not invariably.

The rupture of the hydatid cyst, and the escape of its contents from the kidney, may happen either with or without the previous existence of an evident tumor, and it may occur spontaneously or from some obvious cause, such as a fall, a blow on the loin, or the jolting induced by riding or driving. It occasionally takes place once for all, the cyst becoming completely emptied, and subsequently shrinking; generally, however, this event is repeated at intervals varying from a few days to many years. The rupture may be preceded by pains in the renal region and hæmaturia. When it actually takes place, a sensation as if something had given way internally is frequently experienced by the patient, accompanied with much pain, and this is followed by symptoms more or less resembling those

already described as characteristic of renal colic, these being due to the passage of the hydatid vesicles along the ureter. Thus there are colicky pains, which may shoot down to the thigh or testicle; sometimes retraction of this organ; and, in severe cases, collapse, nausea, and hiccough. Should there have been a previous renal tumor, it might be expected that this should subside, but this is by no means always the case, as the ureter becomes blocked up, and hydronephrosis results. The symptoms last a variable time, and suddenly subside when the vesicle or vesicles reach the bladder, the hydronephrosis being then also relieved, if it should have been produced. After this, pains shooting to the end of the penis set in, with frequent attempts at micturition, strangury, and retention of urine. These symptoms are due to the transit of the vesicles along the urethra, and as soon as they are evacuated, immediate relief follows. They may be removed by the catheter, or, in the case of women, have been known even to be drawn out of the urethra by the fingers. Sometimes they are driven out by the stream of urine with great force. The pathognomonic sign of hydatid disease is the detection either of complete vesicles floating about in the urine, of collapsed vesicles, or of hooklets of echinococci and particles of laminated membrane. These broken elements form a whitish, milky detritus. The number of recognizable cysts discharged may vary from one to a great multitude. Blood is often present in the urine; and there may be a considerable amount of pus, owing to pyelitis being set up.

Hydatid tumor of the kidney sometimes occasions symptoms by interfering with other organs, and these may prove serious when the thoracic organs are impeded in their action. The opening of the cyst into the stomach, intestines, or bronchi can only be known by its elements being respectively vomited, discharged in the stools, or coughed up along with urinary constituents. If it should suppurate or set up suppurative inflammation around, this event will be accompanied with the local and general symptoms already described as indicative of renal abscess. Injury may be the cause of suppuration.

This affection is essentially chronic in its progress, often lasting for many years; but its duration is extremely variable and uncertain. In a large number of cases spontaneous recovery has taken place, usually after discharge of the vesicles. Death may occur from the rupture of the hydatid cyst into the lungs; from thoracic complications set up by the tumor; from suppuration in or around it; from the effects of operation; or from independent maladies.

2. Strongylus or Eustrongylus Gigas.

This worm has been chiefly found in the kidneys and urinary passages of certain animals, such as the weasel, hare, ox, dog, wolf, &c., but is extremely rare in man. Only seven recorded cases have been regarded by Davaine as at all trustworthy. Strongylus belongs to the nematoids, and in general appearance resembles a very large lumbricus. The female measures from 14 to 25 inches in length, and the male from 10 to 22 inches; the breadth is a quarter of an inch or more. In addition to its great size, the strongylus is also characterized by its reddish color, which is attributed to the sanguineous fluid in which it lies; and by having six papillæ or nodules around the mouth. It is quite unknown how this parasite reaches the kidney. It occupies almost exclusively the renal pelvis and calices, but has been found in the ureters in rare instances. The pathological effects which may be produced are dilatation of the pelvis, hemorrhage, pyelitis, and destruction of the kidney. The symptoms which might be expected are those due to the presence of the worm, which acts as a foreign body, and to its pathological consequences, namely, pain in the renal region, disturbed micturition and strangury, hæmaturia, or pyuria.

3. Bilharzia Hæmatobia—Distoma Hæmatobium.

In Egypt, Cape of Good Hope, and certain other hot countries, this parasite, which was first discovered by Bilharz, is of considerable importance, itself or its ova giving rise to serious consequences. Probably it generally enters the body by the agency of drinking water, or of salads, to which the animal or its embryo or ova adhere. Dr. John Harley has suggested that it sometimes gains access through the skin, in consequence of a person bathing or wading in water, the animal fixing itself and implanting its ova in some superficial vein. Generally an entrance is obtained into the portal system of veins, whence the animal and its ova are conveyed chiefly into the minute veins of the mucous and submucous tissues of the intestines and urinary apparatus. It is in connection with the latter that the most important effects are produced, and with these we are now concerned.

The Bilharzia is a small trematode, elongated, soft, and bisexual. Its length is about three or four lines, the male being thicker and shorter than the female, which is filiform. The anterior part of the body is flattened, and bears two suck-

ers; the posterior part is cylindrical. The ova are very minute, oval, pointed at one end, or presenting a pointed tooth or spine at the anterior extremity or on one side. The recent embryo is flask-shaped and ciliated. It is supposed that there are two other distinct forms between this embryo and the adult worm, the intermediate stages being passed in fresh-water mollusks and fish.

The morbid conditions induced by this parasite in connection with the urinary apparatus are chiefly observed in the bladder, but the ureter is also frequently affected, and less commonly the renal pelvis. The ova block up the minute veins, and also make their way through the mucous membrane into the urinary passages. Elevated patches are found on the surface of the mucous lining, consisting of ova mixed with blood, urinary deposits, and crystals of uric acid. Vascular injection, ecchymoses, exudation, and destructive changes ending in ulceration, are also observed. The ureter may be completely blocked up by a mass of ova and urinary sediments, leading to hydronephrosis. Pyelitis may also be excited, followed by pyonephrosis and total destruction of the kidney. According to Griesinger, collections of ova often form the nucleus of a large calculus in Egypt.

The symptoms induced by the Bilharzia will depend upon its effects as above described, and are often very serious. One important point, however, calling for notice is that the endemic hæmaturia which is prevalent in the Cape of Good Hope, Mauritius, and other hot climates is probably due to this parasite. This was suggested by Griesinger, and has been confirmed by the observations of Dr. John Harley in three cases of endemic hæmaturia from the Cape. Numerous ova were found by him in the urine, to which the hæmaturia could be clearly traced. The detection of these ova or their embryos in the urine is the only positive sign of the existence of the Bilharzia disease.

General Remarks on Diagnosis, Prognosis, and Treatment.

It has appeared to the writer expedient, in order to avoid repetition, and to render this part of the subject more comprehensive, to discuss briefly the diagnosis, prognosis, and treatment of growths in connection with the kidney as a whole. To the more important points bearing on these matters attention will now, therefore, be directed.

1. Diagnosis. — From the account which has been given of the clinical history of the different growths in the kidney, it will be evident that most of them may exist without giving rise to any symptoms which can possibly lead to their diagnosis, and even cancer may be completely latent during life. In some forms, such as the benign growths and the simple varieties of cystic disease, this is almost invariably the case, and it rarely happens that they can be recognized clinically. In other instances obscure renal symptoms are present, but it is impossible to determine their cause with any degree of certainty.

In order to make a complete and satisfactory diagnosis, when this is practicable, it is necessary to take into account the history and age of the patient; the presence or absence of urinary symptoms, and their precise nature, the characters of the urine being of special importance; the signs afforded by any tumor present; the general symptoms and condition of the patient; the state of other organs; and the duration and progress of the case. The degree of difficulty experienced in arriving at a correct conclusion varies much in different cases, some being easily diagnosed, while others are at the best obscure and doubtful. The first point to be determined is whether the kidney is the seat of disease; and then the nature of the complaint has to be made out.

Cases in which there is some new growth in the kidney may be practically divided into (1) those in which there is an evident tumor present; and (2) those in which no such tumor exists. The former group includes cancer; a simple cyst which attains large dimensions; cystic degeneration; hydatid disease; and, very rarely, a solid non-malignant growth. Tubercular disease does not form a tumor, but an enlargement may be produced in cases of this complaint from the blocking up of the ureter, and the accumulation of fluids in the renal pelvis; and the same effect may happen as the result of obstruction of this duct by parasites. The chief general characters belonging to renal tumors by which they are distinguished from other forms of enlargement not connected with the kidney, have already been pointed out (see page 718), and this is the first matter to be attended to in the diagnosis. The extraneous conditions with which a renal enlargement is most likely to be confounded are hepatic tumors; enlargement of the spleen; and ovarian or uterine tumors. In exceptional cases difficulty has also been experienced in distinguishing it from fecal accumulations in the colon, ascites, masses of enlarged absorbent glands, psoas abscess, and aneurism —the difficulty in the last case being due to carcinoma of the kidney presenting pulsation and a murmur. Without entering into any lengthy description of the distinctive characters, it may be observed

that in separating renal tumors from those of other organs, the position of the colon in front of the enlargement is always of great importance. Also they cannot be traced usually within the margin of the thorax on either side, or into the pelvis; and on the right side there is a line of tympanitic percussion-sound between the kidney and the liver, due to the presence of a coil of intestine. In the case of ovarian and uterine tumors, a tympanitic sound is elicited in the lumbar region; whereas if there is a renal tumor, this region is absolutely dull. Vaginal and rectal examination will afford material help in diagnosing these conditions. The chief difficulties arise when a kidney becomes so large as to extend beyond its ordinary limits, perhaps even filling the abdominal cavity; when both organs are enlarged; when a movable kidney becomes the seat of disease; or when a growth or cyst springs from some particular part of the organ, and projects into the regions of other organs. It must also be borne in mind that a tumor of the kidney may exist with other morbid conditions, such as ascites or enlargement of other abdominal organs, and then the diagnosis may be very difficult. Under any circumstances caution is necessary, for renal tumor has always been justly regarded as by no means easy of diagnosis, and serious mistakes have been made by the most competent observers. In addition to other modes of clearing up any difficulty, if the enlargement should become very great, an intelligent patient might be able to indicate where it started, and from what direction it grew, and might thus afford material assistance towards forming a correct opinion.

Renal tumors have in the next place to be distinguished from each other, and from other forms of enlargement connected with the kidney, namely, hydronephrosis, pyonephrosis, abscess in the kidney, and perinephritis. Of course every case must be considered in all its details, before attempting to form an opinion; but, so far as the enlargement is concerned, the chief points to be noticed are whether it is unilateral or bilateral; its extent, dimensions, and rapidity of growth; its superficial characters, and the tactile sensations elicited on palpation and percussion; and whether it is painful and tender or not. The diagnostic characters of hydronephrosis, and of the different forms of purulent accumulation in or around the kidney, have already been discussed in their respective articles. With regard to tumors connected with the organ, an enlargement due to a simple cyst is extremely rare; it is unilateral, painless, and presents a sensation of more or less fluctuation. It would be very difficult to distinguish this condition from hydronephrosis. Congenital cystic disease is observed at birth, and presents the characters already described. Cystic degeneration in adults is very rare; both kidneys are usually affected; the sensation afforded on palpation would probably vary in different parts of the tumor. Cancer is generally readily recognized in infants by the great rapidity of its growth, and the large size it attains; it is also distinguished from congenital cystic degeneration in that it begins after birth. Primary cancer of the kidney is almost always unilateral. The growth is often rapid, and the tumor reaches a large size; it may be nodulated and irregular, and the sensations on palpation are generally those of more or less firmness, while they frequently vary over different parts of the tumor. This is also often painful and tender. The association of such a tumor with repeated and profuse hæmaturia may be regarded as highly characteristic of renal cancer, but it must be remembered that hæmaturia is absent in many instances, while there is a case on record in which an enlarged spleen, associated with leucocythæmia, was accompanied with this symptom. The diagnosis of cancer is likely to be materially assisted by the general symptoms; and perhaps by the discovery of secondary formations in other organs. Non-malignant growths so rarely give rise to a renal tumor, that they might practically be put out of consideration. Such a tumor would be very slow in its progress, never attaining any very large size, unilateral, firm on palpation, and probably painless. Hydatid-tumor is slow in its progress, unilateral, rounded, and fluctuating, and might possibly present hydatid-fremitus, which is highly characteristic. The diagnosis of this disease, however, usually depends on the rupture of the cyst into the renal pelvis and the passage of its contents out of the urinary apparatus. It must be borne in mind that in any case of supposed renal tumor, the aspirateur or the exploratory trocar may prove of the greatest value in its diagnosis, both in determining whether the enlargement really belongs to the kidney, and also in making out its nature.

With regard to the second class of cases, namely, those in which there is no tumor, many of them, including the non-malignant growths and syphilitic gumma cannot be recognized. The most important affection belonging to this group is tubercular disease. Its diagnosis is founded on the presence of pyelitis, not due to any other cause, such as calculus; the special characters of the urine; the general symptoms; and the evidence of implication of other organs, especially the lungs and intestine. If pyonephrosis should arise, the previous history of the case will indicate its nature and cause.

Cancerous pyelitis occasionally occurs without tumor, but here, if the urine is altered, it generally contains much blood and but little pus. Hydatid-cysts often rupture before they attain a size sufficient to form an evident tumor, and their existence is then recognized by the escape of their contents. The diagnosis of the other parasitic affections need not be specially alluded to. It must be borne in mind that calculus or other renal disease may be associated with various growths in this organ, and may give rise to their special symptoms. Some of the conditions now under consideration may also burst inwardly in certain directions, and this event would be indicated by corresponding symptoms, according to the direction in which the rupture took place.

2. Prognosis.—This part of the subject may be very briefly discussed. Any actual tumor connected with the kidney may be regarded as involving a serious prognosis, but this differs materially according to the nature of the disease. Any large cyst is liable to rupture; or it may lead to a fatal result by interfering with neighboring structures, or by suppurating after operation. Cystic degeneration terminates fatally; but in adults the disease lasts a long time, death ultimately occurring from failure of the renal functions. Cancer is necessarily a fatal disease, and its course is very rapid in children, but much less so in adults. Occasionally the disease seems to come to a standstill for a time. Hemorrhage, even when repeated, does not seem to hasten death. Non-malignant growths in the kidney are rarely of much consequence. Tubercular disease is extremely serious, and almost always leads to a fatal termination sooner or later, generally within a short period. Hydatid disease ends very favorably in a large proportion of cases, provided the cyst ruptures into the renal pelvis before it attains any large size. Even after a tumor forms, if the cyst opens into this part, recovery not uncommonly takes place. There is a danger, however, lest it should rupture internally, though even then the issue may be satisfactory, provided the cyst communicates with the intestine; when it has opened into the chest, the result has always been fatal. Suppuration of the tumor is dangerous, but recovery may take place afterwards. If the cyst does not open, but goes on increasing in size, the condition becomes very serious, especially as any operation for the purpose of evacuating it is attended with great danger. The other parasitic diseases are of a very grave nature.

3. Treatment. — But little can be done in the treatment of growths in connection with the kidney, and it may be confidently affirmed that no medicine can have any direct influence upon them. It has been supposed that hydatid disease could be influenced by turpentine and numerous other drugs, and the parasite killed, but there is no reliable evidence that such is the case. The chief indications to be borne in mind are as follows:—

a. Symptoms connected with the urinary system often require attention. Pain must be relieved by opiates and other anodynes, with warm fomentations or baths. It might be desirable to take away some blood locally. It may be necessary to give remedies to check hemorrhage, especially in cases of cancer, but in this disease it is not desirable to stop the bleeding if it is only moderate in amount, as the loss of blood may afford relief. Tannic or gallic acid, or acetate of lead, with opium, may be given internally, and ice applied locally. Pyrexia, resulting from pyelitis, needs attention, especially in tubercular disease; and to check the formation of pus full doses of tincture of iron and other astringents may be administered. Symptoms of nephritic colic, due to the passage of blood-clots or hydatid-vesicles, must be relieved by the same means as when they are due to calculus (see page 705). Mild diuretics have been used to aid the escape of hydatids. When these clots or vesicles reach the bladder, they may be broken down by injections or in other ways, and their escape along the urethra may also be aided. The catheter is sometimes of use, and females have been able to drag out hydatids from the urethra.

b. Operative interference may be called for in some cases. Thus it might be desirable to evacuate the contents of a cyst, and especially of a hydatid-cyst, if this should become dangerously large, and show no signs of opening into the renal pelvis. This evacuation could probably be best effected by means of the aspirator. Electro-puncture has also been practised with the view of curing hydatid disease, but without success. Irritant injections have likewise been employed. Extirpation of the kidney might possibly be suggested in some cases of cancer or cystic degeneration.

c. Should suppuration take place in connection with any of these diseases, the treatment must be similar to that indicated when this process arises from other causes. If there is any danger of this event, the patient should be kept entirely at rest, and blood removed locally, or cold applied assiduously.

d. The general condition must be attended to, and any symptoms connected therewith treated as they arise. Good hygienic arrangements and nutritious

food are of much importance in cancer and tubercular disease; in the latter tonics, iron, cod-liver oil and such remedies, are also of essential service. Any symptoms apart from the kidney, which result from the renal affection, must also be treated should they occur; and complications must be looked to, including those resulting from the rupture of any accumulation in connection with the kidney into internal parts.

ANOMALIES OF POSITION, FORM, AND NUMBER OF THE KIDNEYS.

By William Roberts, M.D., F.R.S.

Like various other organs, the kidneys are liable to certain deviations from their natural situation, form, and number. Most of these deviations are congenital, others are acquired at varying periods of life, through accident or disease. They are sometimes capable of being recognized during life, and frequently simulate widely different pathological conditions; many cases escape detection during life so long as the renal functions are satisfactorily performed, and these anomalies may produce little or no inconvenience.

I.—Anomalies of Position.

The kidneys may occupy an abnormal situation and remain permanently *fixed* in that situation, or the misplaced organs may possess a certain degree of *mobility*.

A.—Fixed Malpositions of the Kidneys.

The kidney may be displaced downwards, upwards, or laterally, by the pressure of a tumor growing in its vicinity, or by enlargement of the liver, spleen, pancreas, or supra-renal capsule. In these cases the malposition is *acquired*.

In *congenital malpositions*, the kidney, instead of lying deep in the lumbar region close to the vertebral column, may be fixed in front of the vertebræ, or on the brim of the pelvis, or within that cavity. The most frequent congenital malposition is that where the kidney is found lying obliquely on the sacro-iliac synchondrosis. The kidney has also been found situated beside the uterus, or transversely between the rectum and bladder, or across the prominence of the sacrum.

In those cases where the misplaced organ lies within or upon the brim of the pelvis, it may be felt either through the abdominal wall or through the vagina, and it is of importance to remember the possibility of its being so displaced, lest it should be mistaken for a tumor of a more serious nature. When it is fixed within the pelvis in females, it is liable to embarrass and complicate parturition.

A kidney congenitally misplaced usually deviates more or less from its natural configuration and is associated with malposition of some portion of the large intestine and peritoneum. The renal artery and ureter also necessarily deviate more or less from their normal distribution. Ruysch figures a case in which the kidney lay crosswise with its hilus turned upwards, and the ureter descending behind it. The corresponding supra-renal capsule never accompanies the kidney in its misplacement in congenital cases, but is invariably found to occupy its usual situation in the lumbar region.

In twenty-one cases of congenital malposition which I have been able to collect and compare,[1] the abnormality was in every instance confined to one kidney. The left kidney was much more commonly affected than the right, fifteen out of the twenty-one cases occurring in the left kidney, and six in the right.

It rarely happens that malpositions of this class show any evidence of their existence during life. A curious specimen has been described and figured by Mr. Canton.[2] It was taken from the body of a man who died from bronchitis at the age of twenty-seven, in whom no renal symptoms were manifested during life. The right kidney was in every respect normal, but the left was situated in the angle formed by the bifurcation of the aorta, and, instead of presenting the

[1] For two additional cases of fixed malposition of the kidney, see Hausmann, Monatsschr. f. Geburtsk. xxxiii. p. 401; and Gosselin, L'Union Méd. 1869, p. 115.

[2] Path. Soc. Trans. xiii. p. 147.

ordinary kidney-shape, it was irregularly oval and lobulated on some parts of its surface. The pelvis of the organ was directed almost immediately forwards, and there was dilatation of the upper portion of the ureter owing to the impaction in it of an oxalate of lime calculus weighing two and a half drachms. The left renal arteries were two in number, and took their origin from the anterior portion of the aorta a short distance above its bifurcation. The sigmoid flexure of the colon was placed on the right side of the kidney.

Mr. Durham[1] relates a case in which the misplaced organ formed "a tumor of doubtful character," deeply seated in the hypogastric region, somewhat on the left of the middle line. The patient ultimately died of pulmonary disease, and at the autopsy this supposed tumor was found to be nothing more than the left kidney which was situated over the sacro-iliac synchondrosis, extending over the sacral promontory and into the true pelvis. The kidney presented no distinct hilus and had not the characteristic kidney-shape. The ureter was formed by the junction of four branches, two from the upper and posterior part, and two principal ones from the lower and anterior part. The right kidney and both supra-renal capsules were in the normal position — both kidneys were healthy. The colon formed no sigmoid flexure in the left iliac fossa, but passed across the middle line; and the commencement of the rectum was on the right side of the sacrum. In a case under the observation of Hohl, cited by Rayer,[2] the left kidney was deeply situated on the inside of the psoas muscle, and during two previous labors had retarded the passage of the fœtal head; on both occasions, however, delivery was safely completed.

The *diagnosis* of a misplaced kidney, forming a pelvic or abdominal tumor, is based on the moderate size and smooth elastic feel of the tumor, together with the existence of a slight hollowing or want of fulness of the corresponding lumbar region, denoting the absence of the kidney from its normal situation. When the tumor is reniform, its shape materially aids the diagnosis as a matter of course; in a large majority of such malpositions, however, the characteristic kidney-shape is not preserved.

B.—Movable Kidneys.

Synonyms: — Floating Kidney; les Reins Mobiles, les Reins Flottants (Fr.); Bewegliche Niere (Germ.); Renes Mobiles (Lat.); Rene Mobile (Ital.).

History. — Although vague allusions to mobility of the kidneys are met with in the writings of the older writers, especially in those of Mesué and Riolan,[1] the merit of having first pointed out the practical bearings of this condition, and the signs and symptoms by which it may be recognized during life, is due to Rayer.[2] In this country the subject has been ably illustrated by Dr. Hare;[3] and Mr. Durham has, in his paper previously alluded to, brought together and collated ten cases, being the total number which had been verified by post-mortem examination up to the time he wrote (1860). In Germany, Oppolzer[4] and Henoch[5] have contributed a number of cases, and Fritz[6] has analyzed all the published cases up to 1859. Still more recently the comprehensive essays of Becquet[7] and Rollet[8] have yet farther elucidated the subject. Finally, the present writer[9] has collated seventy cases, partly from the sources indicated above, and partly contributed by himself. On an analysis of these seventy cases the following account is based:—

Physical Signs and Symptoms.—In the normal condition the kidneys are retained in their position by a thick investment of adipose tissue and by a reflection of the peritoneum, which passes over their anterior surface. It can easily be understood how under certain circumstances one or both kidneys are liable to break away from these somewhat lax attachments and float loose among the abdominal viscera, being retained only by their bloodvessels and excretory ducts. The degree of mobility and of change of position which the kidney acquires in these cases varies considerably. When the patient stands upright, the organ in the majority of cases descends below the margin of the ribs and forms an oblong tumor of the shape and feel of the kidney, occupying a diagonal position extending from below upwards and outwards, midway between the umbilicus and the costal

[1] Guy's Hosp. Reports, 1860, p. 407.
[2] Maladies des Reins, tome iii. p. 774.

[1] Manuel Anatomique et Pathologique, Jean Riolan, 1682.
[2] Op. cit.
[3] Med. Times and Gaz. 1858, i. p. 7, &c., and 1860, i. p. 30.
[4] Ibid. 1857, i. 575; and Clin. Européenne, 1859, No. 2.
[5] Klinik d. Unterleibs-Krankheiten. Berl. 1858, Bd. iii. p. 367.
[6] Archives Générales, Août et Sept. 1859.
[7] Ibid. Jan. 1865.
[8] Zur Pathologie u. Therapie d. bewegl. Niere. Erlang. 1866.
[9] A Practical Treatise on Urinary and Renal Diseases, 3d edition; London, 1876, p. 607.

border. It can be pushed in various directions—upwards, downwards, or laterally—over a space of several square inches. In a case observed by myself inflammatory adhesions had taken place to the surrounding structures, and the organ had become permanently fixed in its new position. The displaced organ is usually painless, but handling or compressing it, which can be easily practised in thin persons with flaccid abdominal walls, gives rise to peculiar sensations of nausea or sinking.

When the patient lies in the horizontal posture the kidney can be replaced in its normal site in the lumbar region, but as a rule, as soon as the pressure is withdrawn it resumes its abnormal situation.

The position of a movable kidney is greatly influenced by the respiratory movements and by the posture of the body; thus deep inspiration causes it to descend, and deep expiration to ascend, and the force of gravity drags it to whatever side the patient's body is inclined. In the slighter cases half or three-quarters only of the length of the organ can be felt through the soft abdominal walls along the borders of the false ribs. Most commonly, however, the displacement is to a much greater extent. In a case mentioned by Johnson the kidney had drifted below the umbilicus, and in another related by Day, it lay in the iliac fossa and could be moved over an area of three or four inches; in a case under my own observation the organ could be felt lying on the edge of the pelvis in the vicinity of the cæcum.

When the patient is recumbent the displaced kidney occupies a higher position than after long standing or walking. Percussion over a movable kidney yields not a dull sound, but a muffled tympanitic note. On examining the loins, a slight hollowing or flattening of the renal region is observed on the side of the displacement, and the percussion sound is tympanitic, indicating that the intestine occupies the normal site of the kidney: if the organ be reinstated in its original position, the natural prominence in the lumbar region is restored, and the bowel sound disappears.

The subjective symptoms vary considerably. Occasionally the symptoms are so slight and obscure that the attention of the patient is not drawn to the anomaly; and it has on more than one occasion been detected by an accidental examination of the abdomen during the course of some other complaint. As a rule, however, considerable suffering and inconvenience result from the displacement. The most constant symptom is a dragging pain in the affected side aggravated by walking or standing; this is of a neuralgic character and radiates from the neighborhood of the displaced organ into the loins, round the waist, down to the hypogastric region, and along the thighs.[1] Sometimes the sufferers are conscious of the existence of a movable tumor in the abdomen, and this occasions great mental distress and not unfrequently leads to a condition of confirmed hypochondriasis. In one case the movements of the displaced kidney were mistaken for those of a child in the womb. Sometimes there is disturbance of the gastric functions, more frequently the bowels are affected either with fitful diarrhœa or with constipation; whilst in other cases there are occasional attacks resembling biliary or nephritic colic, accompanied with nausea, vomiting, shivering, faintness, and signs of local peritonitis; during such attacks the kidney becomes swollen and forms an immovable, painful tumor in the abdomen. In these cases the kidney generally resumes its former size and mobility on the subsidence of the paroxysm, which usually takes place after a few days' rest in bed and the use of opiates and warm local applications; but occasionally inflammatory adhesions are formed, and the kidney remains permanently fixed in its new position.

The origin of these attacks is somewhat obscure: they sometimes set in suddenly while the patient is in bed, without any appreciable cause; more frequently, however, they follow some unusual exercise or an indigestible meal, or they occur at the menstrual periods. It is not improbable that, at least in some cases, they are due, as to a kind of strangulation of the kidney, from the pressure of the displaced organ on its own ureter, and a consequent obstruction to the flow of urine, leading to acute engorgement of the organ, with dilatation of the pelvis and pyelitis. This hypothesis seems to derive support from the observation of Rollet,[2] that the urine sometimes becomes bloody and purulent for some time after one of these attacks.

The excretion of urine, which is always quite healthy, generally remains unaffected; occasionally, however, micturition is unnaturally frequent and accompanied with more or less pain.

Epigastric pulsation is a frequent concomitant of mobility of the kidneys, and in three cases this was a prominent symptom. In four cases hydronephrotic distension of the renal pelvis coexisted with mobility of the kidney. Among other

[1] In two cases under the observation of Rayer (op. cit.) the pain extended into the right ham, along the posterior part of the thigh and even as far as the ankle. It sometimes seemed to start from the right loin and extend into the labia majora.

[2] Loc. cit. p. 20.

complications which have been observed in these cases may be mentioned Bright's Disease, the discharge of uric acid gravel, œdema of the lower limbs from compression of the ascending cava by the displaced kidney, and obstinate constipation from similar compression of the colon.

Etiology.—Mobility of the kidneys is much more common in women than in men, and on the right side than on the left. Thus of the seventy cases collected by the writer, sixty-one occurred in women and only nine in men. Information as to the kidney affected is given in sixty-five cases—in 42 of which the right alone, and in 9 the left alone was movable; while in 14 cases both kidneys were movable. The *age* of the patients ranged between sixteen and sixty-five years—the greatest number being between twenty-five and forty, thus corresponding roughly to the child-bearing period in women.

Judging from my own personal experience, this affection is much more common than is generally supposed; and I am inclined to the belief that many cases of obscure abdominal pain and gastro-enteric disturbance are due to this cause. A large number of cases are undoubtedly overlooked. Rollet states that out of 5500 patients admitted into Oppolzer's clinique and examined carefully with regard to this anomaly, 22 had movable kidneys—a proportion of one in 250 cases.

In a certain number of cases, no clear determining cause can be discovered; but as a rule the antecedent history of the patient discloses some circumstance or circumstances to which this anomaly can be attributed. The displacement is due in many cases to repeated or protracted labors, and this partly explains the greater frequency of movable kidneys in women than in men: the alternate tension and relaxation of the abdomen, and the convulsive muscular efforts accompanying parturition, must obviously have a tendency to loosen the attachments which hold the kidney in its place and favor its migration under the force of gravity into a lower position in the abdomen.

The disproportionate frequency of movable kidney in the female sex, and especially on the right side, is in part due to tight-lacing. With reference to this point, Cruveilhier[1] observes: "I have often observed in women who wore tight stays, the right kidney to lie sometimes in the right iliac fossa, sometimes in front of the sacro-iliac synchondrosis, sometimes even in front of the vertebral column at the level of the adherent border of the mesentery, in the substance of which it was placed. The kidney thus displaced enjoys a certain mobility. This displacement of the kidney arises when the pressure exercised on the liver by the stays dislodges the right kidney from the kind of niche which it occupies on the under surface of this organ.

"If the left kidney is not so frequently displaced as the right, that is owing to the fact that the left hypochondrium occupied by the spleen and the great end of the stomach bears the pressure of the stays with much more impunity than the right."

It seems probable that in some cases mobility of the kidneys has been determined by rapid emaciation and the removal of the capsule of adipose tissue which naturally invests the kidney; thus Oppolzer invariably found a deficiency of the cushion of fat about the kidney in the cases examined by him, and in a case dissected by Mr. J. Adams[1] "the only peculiarity remarkable was that the kidney appeared bound down more loosely than usual, and the old lady, from having been very fat, had become somewhat thinner, and her integuments appeared very lax throughout."

In a considerable number of cases, more especially in men, displacement and mobility in the kidney is produced by a blow on the loin, a sudden fall or jump, violent running, dancing, riding, or some inordinate muscular effort[2] or succussion of the body. These causes generally produce their effect suddenly, or sometimes more slowly, as in one of Henoch's cases, where no symptoms supervened until about half a year after a fall from a horse.

Rayer relates the case of an old woman whose right kidney was displaced and movable, apparently from its being dragged down, or at least left free to descend by its own weight, in consequence of displacement of the peritoneum from a hernia of the cæcum. It is probable that the hydronephrotic condition which was found in four of the recorded cases acted in a similar way in dragging the kidney from its normal site by the pressure of the distended pelvis and consequent increase in the weight of the organ.

Becquet[3] has enunciated a novel theory to explain the liability of women to mobility of the kidneys. He says: "On the breaking forth of the menstrual flux, the kidneys are associated in the congestion of the generative organs and become swelled. This fact, less rare doubtless than is usually supposed, perhaps even physiological, does it not explain the renal pain so often felt at the menstrual

[1] Traité d'Anatomie Descriptive, tome iii.

[1] Med. Times and Gaz. 1857, i. p. 651.

[2] In two cases observed by the writer, the displacement was perceived soon after a violent attack of bilious vomiting.

[3] Arch. Générales, 1865, i. p. 21.

periods, especially in women who are subject to dysmenorrhagia? Thus swelled and rendered heavier, the kidney, and especially the right kidney, strains the feeble attachments which retain it, and tends to start out of its place. Soon the congestion subsides, and the organ returns to its original position; a second congestion displaces it further; and a third still more; the kidney, becoming each time heavier from the incompleteness of the resolution, comes to occupy a lower position; and thus gradually and at length, but not without suffering, breaks loose and floats in the abdominal cavity." In a case under the observation of the writer, the displaced and movable kidney seems to become larger two days before the catamenia appear; it becomes sensitive to the touch, and at times somewhat painful even without being touched; and in a case observed by Dr. Ritchie and cited by the writer, an opportunity was afforded of watching the condition of the kidney during two menstrual periods, when its size was seen to be increased by fully one-half, and it was much more sensitive to the touch. These facts, so far as they go, lend an air of feasibility to the theory of Becquet.

Hitherto we have been discussing only those cases where the mobility of the kidney appears to be due to circumstances arising after birth, and where there is generally evidence of the present or past existence of some obvious cause of displacement and mobility. The majority of cases belong to this category, but mobility of the kidneys may be congenital; when so, it is commonly associated with an anomalous arrangement of the peritoneum, or with an abnormal origin and distribution of the renal vessels.

In two cases observed by Dr. Priestley[1] and M. Girard[2] respectively, the peritoneum was found reflected over the posterior as well as the anterior surface of the kidney, so as to inclose it within its folds, thus forming a distinct meso-nephron and allowing it very considerable motion in the abdomen. In the body of a woman, examined by Mr. Durham, mobility of the left kidney was due to an abnormal arrangement of the peritoneum. The peritoneum, instead of passing over the anterior surface of the kidney, only just touched its lower border, and after having formed the descending meso-colon, again touched its outer border. The lesser sac of the peritoneum also passed so far to the left as to cover the posterior surface of the spleen, and so far downwards as to touch, and be reflected from, the upper border of the kidney. There was thus no distinct meso-nephron; but the kidney, instead of being supported and retained in position by a single layer of peritoneum, was left free to move between and beneath three diverging layers.

[1] Med. Times and Gaz. 1857, i. p. 263.

[2] Journal Hebdom. No. 53, p. 445, cited by Rayer, op. cit.

The Diagnosis as a rule is easy; and errors have arisen rather from the possibility of such a condition not having occurred to the practitioner, than from any inherent difficulty in detecting it.

The diagnosis chiefly depends on the presence of a hard, smooth, slippery, movable tumor having the size and shape of the kidney, or approaching thereto, on one side of the abdomen, generally in the hypochondriac region; it can at will be pushed with the thumb and fingers into the lumbar space, and out of it again. When the corresponding loin is examined, some degree of flattening or hollowing can usually be detected in the normal site of the kidney, and on percussion over this hollow, a tympanitic sound is elicited. The diagnosis may however be embarrassing in obese people and where the mobility and malposition are slight. It is necessary to remember that the displaced organ may contract adhesions in its new position; these will of course restrict the area over which it can be moved.

Treatment.—The most obvious indication is to replace the kidney in its normal site, and retain it there; if this cannot be effected on account of adhesions, endeavors must be made to maintain it steadily in its new position, so that it shall not drag asunder its new attachments[1] by its own weight. These objects are attained by the application of a belt or bandage round the abdomen, after the kidney has been replaced in its proper position. This with careful regulation of the bowels (as any fecal accumulation aggravates the inconveniences of this affection) is frequently all the treatment necessary. Sometimes, however, more steady pressure and support can be afforded by means of a pad fitted over the situation where the kidney usually protrudes, in addition to the belt or bandage. These mechanical appliances cannot in every case be borne, but usually relief, partial or complete, is afforded by them.

If anæmia or any other constitutional vice be present, it must be remedied by appropriate treatment. Restoration of the tone of the abdominal muscles, which are generally relaxed and flaccid, is probably the most effective means of reducing to a minimum the discomforts associated

[1] Rollet (op. cit.) states that in cases where the diagnosis is undoubted and the adhesions recent, the kidney may be forcibly pushed into its normal position and the affection be thus at once and permanently cured.

with movable kidneys. For this purpose, ferruginous and other tonics and shower baths, with the avoidance of tight lacing and all violent modes of exercise such as equitation, dancing, and the like, are the best means to be used.

When symptoms of so-called strangulation of the kidney supervene — violent pains, sickness, frequent micturition, enlargement and excessive tenderness of the tumor—complete rest in the recumbent posture, hot poultices or even leeches applied over the seat of pain, and the hypodermic administration of morphia, are the measures most likely to afford relief.

II. Anomalies of Form.

Deviations from the normal shape of the kidneys may be *congenital* or *acquired* at different periods of life, as a result of the pressure of tumors or morbid enlargements of neighboring viscera. Some of these abnormalities have been already adverted to incidentally, in the article on fixed malpositions of the kidney. The lobulated character of the gland, which is the normal condition during fœtal life, sometimes persists, to a greater or less extent, during the remainder of life. Depressions on the surface of the kidney are not uncommon, dividing the organ into two or three indistinct irregular portions. Sometimes although both kidneys are perfectly healthy, one is two or three times larger than the other; this arises probably from deficient development of one renal artery.

Curious anomalies in the structure and development of the pelvis of the kidney and the ureter are occasionally encountered; thus in a case recorded by Sir Henry Thompson,[1] the kidney was provided with two pelves which united so as to form a single ureter about an inch below their necks. Mr. Wood[2] relates a case in which the left kidney had two ureters which remained distinct until within an inch of the bladder. The right kidney of the same patient, in addition to a ureter which entered the bladder at the usual place, was provided with an aberrant ureter which was sacculated and about the thickness of a goose-quill; it was connected with a dilatation (partial hydronephrosis) at the upper extremity of the kidney, and opened into the bladder close to the vesical orifice of the urethra. Dr. C. Kelly[3] records a case of solitary right kidney with two ureters, the upper of which descended in the usual manner, while the lower one passed behind it, and following the course of the left common iliac artery, entered the bladder in the usual position of the left ureter. There were three arteries, the upper of which occupied the usual position of the right renal artery, and three veins; no corresponding vessels existed on the left side.

Horse-shoe Kidney.—This abnormality consists in the coalescence of the two kidneys into one by means of an intermediate transverse portion, which connects their lower ends across the front of the vertebral column, so as to form a crescent or horse-shoe with the concavity directed upwards. The two halves of a horse-shoe kidney are usually complete and perfect in themselves, having each a distinct pelvis and ureter. The isthmus usually consists of proper secreting structure, but sometimes it is composed merely of condensed fibrous tissue. Most frequently the ureters descend in front of the transverse portion, but more rarely they pass behind it; in a drawing in the possession of my colleague, Dr. Renaud, the two ureters are seen crossing each other on their way to the bladder. In thin persons a horse-shoe kidney may be felt through the abdominal walls—and may thus be mistaken for a morbid growth.

No interference with the renal functions results from this abnormality; but it is well to remember the possibility of its occurrence, for if dilatation of the pelvis of such a kidney took place, the central position of the tumor near the spine would be very liable to direct the attention of the observer away from the idea of hydro- or pyo-nephrosis, if the possible existence of this "horse-shoe" condition was overlooked.

III. Anomalies of Number.

Supernumerary Kidneys.—A number of instances are cited by Rayer in which there existed one or two supernumerary kidneys, each with its separate excretory duct.

Solitary Kidney.—It has been repeatedly observed that only a single kidney has been found in the bodies of persons who during their lives had suffered from no derangement of the urinary function. In such cases, the existing kidney is always hypertrophied, and no interference with the secretion of urine takes place so long as it remains healthy; but should it become the seat of inflammation, or should its excretory duct become obstructed from the pressure of a tumor, or the impaction of a calculus, partial or total suppression of urine takes place accompanied by very alarming symptoms, and ending in fatal uræmia.

Mosler and Rayer have recorded a number of cases of solitary kidney, and the

[1] Path. Soc. Trans. vol. vi. p. 267.
[2] Ibid. vol. vii. p. 261.
[3] Ibid. vol. xix. p. 274.

writer has collected numerous others, amounting in all to twenty-nine cases, of which twenty-two occurred in males, six in females, and in the report of one the sex is not mentioned. One was a male infant seven days old, another a boy of seven years; two of the cases were fifteen years old, four between twenty and thirty, three between thirty and forty, four between forty and fifty, two were sixty, and one sixty-five at the time of death—the remainder occurred in adults whose age is not recorded.

The left kidney was absent in sixteen cases, and the right in twelve, while in one case the side is not mentioned.

The defect was congenital in nineteen cases, while in three it had been acquired during life through the previous destruction of one of the organs; in seven cases it could not be determined whether it was congenital or acquired.

The renal vessels and ureter of the defective side were always, and the corresponding supra-renal capsule generally, wanting when the defect was congenital. In Dr. Hillier's case, the aorta gave off three arteries to the existing (right) kidney, which was provided with two ureters; the left supra-renal body was in its normal situation.

The cause of death was specified in twenty-four of the recorded cases. The impaction of a calculus was the most frequent cause, as it led to a fatal issue in ten of these cases, while inflammation of the kidney produced death in three, and phthisis in two cases. Death resulted in one case from each of the following causes: pressure of a cancerous tumor on the ureter, impeded flow of urine from congenital phimosis, valvular disease of the heart, peritonitis, meningitis, double pneumo-thorax, typhus fever, "accidental injury," and rupture of the kidney. In an epileptic girl under the care of my colleague, Dr. Leech, solitary kidney was associated with double uterus and vagina.

Absence of both Kidneys.—Rayer has collated a number of examples of this anomaly in still-born children, there being entire absence of both kidneys together with the ureters and bladder. This abnormality seems to be not uncommon in anencephalous monsters.

DISEASES OF THE URETER.

By Frederick T. Roberts, M.D., B.Sc., F.R.C.P.

Most of the morbid conditions to which the ureter is liable have already been incidentally alluded to in some of the previous articles on Diseases of the Kidney, and the consequences have been discussed; it will now, therefore, be only requisite in the first place to give a concise summary of these morbid conditions, and to indicate their nature; secondly, to point out the signs by which they are recognized clinically, and the effects which they produce; and thirdly, to offer a few observations on their treatment.

A. Summary of Morbid Conditions.

1. Congenital Malformations.—The ureter is occasionally found to be completely impervious, being converted into a solid cord; or its lower opening is closed, or is surrounded by a dense fibrous ring. Again, it may open into the renal pelvis in an unusual manner, entering at an acute angle, and presenting a valve-like arrangement, which prevents the escape of the urine. One of the most common malformations is the presence of two ureters in connection with one kidney, which may be associated with a divided pelvis, and the two ducts may open separately into the bladder, or join before they reach this viscus.

2. Injuries.—The ureter has in rare instances been ruptured across as the result of a crushing accident. It has also occasionally been torn in connection with a gunshot wound. Lesser degrees of injury have been supposed to set up inflammation and its consequences in some cases. Under this head may also be mentioned the fact that the ureter sometimes ruptures as a consequence of injury from within, due especially to calculus, which either directly destroys the wall of the tube, or first originates ulceration, and this subsequently leads to perforation. This tube has also been cut across during the performance of operations, such as ovariotomy.

3. Inflammation.—This condition of the ureter is often associated with inflammation affecting the bladder or renal pelvis, or it may be independent, originating from irritation of the inner surface of the tube by foreign bodies, especially calculi, or possibly from external injury. The lining membrane is reddened and swollen, and it may present flakes of lymph, or yield a muco-purulent fluid. In some cases more or less ulceration ensues. In others the walls of the ureter are infiltrated and thickened, and they may become very firm as the result of a chronic inflammatory process.

4. Morbid Growths.—The ureter is liable to be affected with cancer, when this disease implicates other parts of the urinary apparatus. It seems to have been chiefly observed as the result of extension from the bladder. Tuberculous disease also generally involves the ureter along with the kidney and bladder. A deposit of so-called scrofulous material forms; the mucous lining becomes destroyed or ulcerated more or less extensively, with proportionate discharge; the walls are frequently much thickened and indurated; and the canal is considerably narrowed. In cases of the affection due to the Bilharzia Hæmatobia, the ova of this parasite are found in the ureter, either alone or mixed with urinary gravel and uric acid crystals. They constitute irregular and distinct patches, slightly elevated, of a grayish-yellow color, soft, but firmly adherent.

5. Obstruction.—The obstruction of the canal of the ureter is highly important, and it may arise in the following ways: (*a*) As the result of morbid changes in the walls, in connection with some of the conditions already alluded to. Thus the mucous lining may be swollen, or a deposit formed upon it; the entire walls may become thickened and infiltrated; or cicatrization may take place after ulceration. In either of these ways the channel of the ureter becomes more or less encroached upon, and it may even be completely obliterated in some part of its course. This obliteration may also be congenital. (*b*) From internal obstruction by foreign bodies or morbid products. Of these the most important is a calculus, which only temporarily blocks up the tube, or becomes firmly impacted in it; but obstruction may also arise from fragments of cancerous or tuberculous matter, hydatid-vesicles, blood-clots, or inspissated pus. (*c*) From external compression. The ureter is liable to be pressed upon from the outside by tumors connected with the kidney itself, by abnormal renal vessels, or by neighboring growths, such as an ovarian cyst or an uterine tumor. Under these circumstances its canal may also be completely closed. (*d*) From twisting of the duct upon its own axis. This is a rare cause of obstruction of the ureter.

6. Dilatation.—As a consequence of any of the causes of obstruction just mentioned, the ureter is liable to become more or less dilated above the seat of such obstruction, and at the same time frequently becomes lengthened and tortuous. Moreover, if several concretions or other bodies pass down the ureter in succession or at intervals, the tube tends to remain permanently dilated, so that the passage of these bodies becomes less difficult in course of time. The ureter may also be distended along with the other portions of the urinary apparatus, in consequence of some obstruction affecting the canal of the urethra. The extent of the tube which is dilated depends upon the seat of obstruction, when the enlargement is due to this cause. The dilatation is usually not uniform, but unequal, and a sacculated appearance is consequently produced. The degree of distension also varies; in several instances the ureter has become so enlarged as to resemble the small intestine. Generally its walls are thickened, and the muscular tissue may be hypertrophied; on the other hand, atrophy is occasionally observed, and the tube has even been known to have undergone such attenuation that it has ultimately given way. Below the seat of any obstruction, the ureter generally becomes narrowed and wasted.

7. Hypertrophy and Atrophy.—These conditions need merely be mentioned, as they have been sufficiently noticed above. Thickening of the walls of the ureter from inflammatory infiltration must not be confounded with true hypertrophy.

B.—Symptoms and Effects.

The principal clinical phenomena which may be observed in association with the morbid conditions of the ureter which have been indicated in the preceding remarks, are attributable to their effects, and are not immediately connected with this tube. In some instances there will be no symptoms at all, but as a rule a knowledge of the condition present may be derived from a due consideration of the signs revealed by a careful clinical examination. The phenomena may be summarized as follows:—

1. The ureter is liable to become the seat of painful sensations. Probably inflammation or ulceration of this tube may be accompanied with more or less pain or

uneasiness in its course. It is, however, in connection with the passage of calculi or other materials from the pelvis of the kidney to the bladder, that the severe suffering is associated which constitutes renal or nephritic colic, the characters of which have already been described under Calculous Disease. The rupture of the ureter may be attended with a sudden pain, accompanied with the feeling of something hot being poured out. Even when there is no spontaneous pain, tenderness may be felt in some cases along the course of this tube.

2. One of the most serious effects of many of the morbid conditions of the ureter is that obstruction is produced, either temporarily or permanently, and consequently urine or morbid fluids which form in connection with the kidney cannot escape, but accumulate above the seat of obstruction. Hence follows in different cases hydronephrosis or pyonephrosis, with their several consequences, and the clinical signs of these conditions become the data upon which a knowledge is founded of what is taking place in connection with the ureter. Should the cause of the obstruction be got rid of, the fluid collection will escape suddenly, and, as has already been pointed out several times, the tube may be alternately blocked up and free, with corresponding changes in the hydronephrosis or pyonephrosis. Concretions of phosphate and carbonate of lime are also liable to form in the renal pelvis and calices, if the ureter is rendered impervious in any way.

3. It may be mentioned that in some affections the ureter itself forms morbid products, such as pus, and these become mixed with the urine; it is quite impossible to distinguish this admixture as coming specially from the ureter, as there are always similar products derived from the renal pelvis, and they cannot be separated. A similar observation applies to the escape of blood from the ureter.

4. The rupture or perforation of the ureter is attended with grave consequences. The urine escapes, and sets up violent inflammation in the parts around, leading to the formation of abscesses or to peritonitis, with the accompanying symptoms, both local and general. The termination is always fatal.

5. Dilatation of the ureter may in some cases of renal calculus be recognized by the fact, that when a number of concretions are passed in succession or at intervals, the attendant suffering and other symptoms become markedly diminished, on account of their more early passage along the dilated tube. This may, therefore, be a favorable sign in such cases. Dilatation from other causes cannot be definitely detected.

6. Physical examination by manipulation along the course of the ureter may enable certain conditions associated with this tube to be discovered. Thus a calculus lodged in it may occasionally be felt, or its passage along the duct may be traced. Possibly, also, if the ureter is much dilated and hypertrophied, it might be recognized by careful manipulation through the abdominal walls.

7. General or sympathetic symptoms are not uncommonly associated with diseases affecting the ureter. As illustrations may be mentioned the symptoms accompanying the passage of a calculus; more or less collapse, followed by pyrexia, in cases of rupture of the ureter; and the wasting, hectic, and night-sweats observed in connection with tuberculous disease.

C.—Treatment.

It is not often that any direct treatment can be applied to the ureter, and the objects to be borne in mind may be stated in a few words. The first and most important point is to assist the passage of any foreign body along the tube, if lodged there; to relieve the accompanying symptoms; and to prevent any injurious effects. These indications are carried out by keeping the patient at rest; the administration of opium or other anodynes; the use of warm fomentations or baths; the local removal of blood in some cases; and by careful manipulation along the course of the ureter. (See Calculous Disease.) If anything is known to be pressing upon the ureter, this also must be got rid of, if possible. Often, however, nothing can be directly done to remove obstruction affecting this tube. Under such circumstances the treatment must be directed to the effects of this condition which are associated with the kidney, such as hydronephrosis or pyonephrosis. If there are signs of inflammation of the ureter, hot fomentations should be freely used, or in some casts it might be advisable to apply a few leeches along its course. Nothing can be done in cases of rupture of the ureter, except to keep the patient absolutely at rest, and to treat the consequences of the lesion. General treatment is indicated in certain forms of disease, similar to that described as applicable to the same affections when they involve the kidney, of which they form a part.

AFFECTIONS OF THE BLADDER.

By Sir Henry Thompson, M.B., F.R.C.S.

The bladder is subject to numerous maladies; some of them are of common occurrence. Not a few are associated with conditions either of the organ itself, or of some adjacent part, which require mechanical treatment, and therefore fall naturally under the care of the surgeon. Such are tumors of the bladder, calculus, hypertrophy of the prostate, stricture of the urethra, &c., all of which may demand the use of instruments. For other maladies, on the contrary, such treatment is not only not necessary, but would be prejudicial if employed. It is essential therefore that the physician should understand clearly when to treat solely by medicine and its adjuncts, and when to invoke the surgeon's aid. Hence, to consider, as far as it is possible to do so in somewhat narrow limits, the diagnosis of this group of disorders, as well as to advise the medical treatment, will be the aim of the present sketch.

The following table comprises the principal affections which it will be necessary to allude to in the following pages:—

Inflammation of the bladder—acute, subacute, or chronic catarrhal.
Gout in the bladder.
Incontinence of urine.
Retention of urine.
Atony and over-distension of the bladder.
Paralysis of the bladder.
Organic changes in the bladder—hypertrophy, sacculation, tumors and growths.

Inflammation of the Bladder—Acute.—This affection is manifested in two distinct forms, differing considerably in gravity and intensity; yet both are essentially acute, since in each the invasion is sudden, the progress is rapid, and fever is present. The more severe form is mostly due to traumatic causes, such as surgical operations, and injuries; to calculus; to the later stages of prolonged retention of urine from obstructions in the urethra; and to chemical agents, as cantharides, &c. It may also occur by continuity from inflammation of the prostate, or of the kidneys. The symptoms are excessive frequency and pain in passing water, pain about the loins, pelvis, and perineum, and in the penis; tenderness to pressure above the pubes and in the rectum. The urine is loaded with inflammatory products, mucus, pus, and blood, and often shreds of lymph in some quantity; the blood increasing rapidly as the disease advances. Considerable fever is present, often marked by repeated attacks of rigors, which are followed by heat and then by profuse sweats.

The less severe form often arises from gonorrhœal inflammation spreading backwards, from exposure to cold, from chemical irritants; sometimes in peculiar idiosyncrasies, perhaps occasionally from gout, and even from indigestion. The symptoms are as follows: first, frequent micturition, inability to retain the urine for an instant when the want to pass it is experienced. Urine previously clear becomes cloudy from admixture of simple mucus, not to be confounded with opacity produced by the pressure of lithates or of amorphous phosphates, the former disappearing by heat, the latter by the addition of nitric acid; often there is a moderate degree of fever; the patient has usually accelerated pulse, loss of appetite, and thirst. Some pain is generally felt above the pubes, in the perineum and sometimes in the urethra, and micturition is also in some cases painful.

Treatment of the two forms.—First, it is necessary to ascertain if retention of urine is present, since it may be a cause or a serious complication of the malady. The presence of retention may be suspected if there is difficulty in expelling the urine, as well as great frequency in the attempts to pass it, and if the secretion is alkaline; but the condition can only be determined by examining the region. There may be a swelling in the situation of distended bladder above the pubes, dull to percussion, and distinguishable by a finger introduced into the rectum; whether or no, this important question can only be solved by passing a catheter with the utmost care and gentleness. Supposing, however, a case in which the cystitis is not due to surgical operation and is not one requiring mechanical relief, the following is an outline of the treatment. Hot fomentations or poultices to the suprapubic and perineal regions; hot hip-baths or bidets. Gentle action of the bowels is to be insured by mild aperients; diluent drinks should be taken freely, and frequent small doses of alkali, full doses of

henbane, or small doses of morphia or chlorodyne. Suppositories of morphia or of opium are very useful when pain and irritability of the bladder are extreme. When the attack is subsiding, or if it is slight throughout, the patient may take three or four ounces of the infusion of buchu three times a day, or a pint of strong decoction of triticum repens daily.[1] No alcoholic stimulants should be permitted, but the food should be nutritious, light, and digestible.

Chronic Cystitis.—This affection in a mild form often appears to be associated with the existence, as a primary affection, of morbid changes in the kidneys; and sometimes follows the formation of renal calculus. Its presence is also very commonly the sign of obstruction in the urethra, or of calculus; more frequently still of prostate hypertrophy; rarely, of tumor of the bladder. Many of the symptoms do not speedily yield to medical treatment, the presence or absence of these conditions must be verified by a practised hand. For it is never to be forgotten that in chronic cystitis, the source of the disease is almost always revealed by a physical examination. Its most frequent causes are the following: chronic retention of urine from obstructive disease of the urethra (stricture in early and middle life, hypertrophy of prostate in advancing years); atony of the bladder, occasionally paralysis, foreign bodies in the bladder, sacculi, dilated bladder, tumors; sometimes abnormal conditions of the urine itself, and lastly it exists as a sequel of the acute malady. The symptoms are: micturition increased in frequency, usually with some pain preceding the want to perform it; pains about the pelvis and perineum. The urine is more or less cloudy from the presence of an undue quantity of mucus from the lining membrane of the bladder. This is always present in all forms of chronic cystitis; without it indeed there is no inflammation. But the amount and the character of the mucous deposit differ greatly in different cases; thus, while in ordinary examples the quantity is inconsiderable, only producing cloudiness of the urine, in others it is so great as to form a large dense mass of semi-gelatinous material, giving rise to the term "catarrh of the bladder" as a mode of distinguishing it.

The medical treatment of chronic cystitis consists first in providing that the urine which enters the bladder from the kidneys, shall arrive in a state as little liable to irritate the viscus as possible. It should not be too concentrated, hence diluent drinks are usually beneficial; nor too acid, on which account liquor potassæ or citrate of potash in small but frequently repeated doses are often useful. The urine may be alkaline when it issues from the bladder from admixture of mucus or from ammonia produced by decomposed urea, although it has been secreted with the usual or even with an augmented degree of acidity, and if this be barely neutralized in the manner suggested, the inflamed bladder is less irritated and less inflammatory products are found than would otherwise be the case (Dr. G. Owen Rees). Then there are numerous infusions and other agents which appear to exert a salutary influence on the urinary tract of mucous membrane, when it is inflamed, which shall be briefly noticed. The infusions of buchu, uva ursi, parsley breakstone, alchimella arvensis and common hop, the decoctions of pareira brava, triticum repens, marsh mallow, linseed and pearl barley, are all useful, but should be administered in much larger doses than are usually given, of none giving less than ten ounces daily. Sometimes small doses of the balsams; such as sandal-wood oil, copaiba, or of compound tincture of benzoin, of benzoic acid, are useful; more commonly they merely derange the stomach and are without value. The action of the bladder is also tranquillized by sedatives of the nervous system, such as henbane, given in full doses, thirty to sixty minims frequently repeated; belladonna in moderate quantity, morphia in small doses. The tincture of the perchloride of iron has a reputation in some forms of the malady, and with justice.

Counter-irritation is a valuable part of the treatment; the best form perhaps being the application of a hot linseed poultice the surface of which is sprinkled with flour of mustard, to the sacral, suprapubic and perineal regions.

Injections of the bladder with warm water, or with very weak solutions of acetate of lead, of hydrochloric acid, of nitrate of silver, carbolic acid, biborate of soda and glycerine, quinine, &c., are of great value, but as they belong strictly to surgical treatment will not be further named here. They are especially applicable to those cases in which the mucous discharge is excessive.

I have already named *gout* as an undoubted, although rare, cause of cystitis. I have, still more rarely, witnessed an attack of gout on the bladder, without inflammation of that organ. A patient, whose family and personal antecedents are notably gouty, has sudden and periodical attacks of acute pain in the joints of the lower limbs, and sometimes also in the region of the bladder, the latter oc-

[1] The best formula is the following: Boil four ounces of triticum repens in a quart of water, gently reducing it to a pint; strain and cool; let a third part be taken three times a day.

curring simultaneously or alternately with the arthritic pain. There is general fever, furred tongue; the urine is soon charged with lithates, but inflammatory products are absent. The attack lasts a day or two, and the patient's sufferings are distressing while the bladder is affected; micturition being very frequent, and extremely painful. It is relieved by large doses of morphia, and ceases suddenly. The patient exhibiting such phenomena has, of course, no obstructive or other organic disease of the organs whatever, and is perfectly well in the interval of the attacks, which may occur once a year or so. The treatment consists, first, in hot hip-baths, with large doses of any opiate which best agrees with the patient, followed by free mercurial purgation, and afterwards by the regimen and management best adapted to the gouty patient.

Incontinence of Urine.—By this term is intended the habitual escape of urine without the knowledge, or against the will, of the patient, and without any power on his part to control the flow. In the adult, male or female, surgical examination is essential, in order to discover the cause. But the condition is very common in childhood, and is generally amenable to medical treatment. Usually it occurs only during sleep, although in a few instances the incontinence takes place when the child is conscious during the day. It is often almost congenital, and continues, if not checked, even up to and beyond the time of puberty; frequently being the cause of great discomfort, and even of positive injury, by incapacitating the subject of it from school life, and other engagements. It occurs in children of very different temperaments, perhaps more commonly in those whose intellectual capacity is below the average than among others. The treatment consists, first, in permitting only small quantities of fluid for diet after the mid-day meal, in taking up the child after his first sleep when the elders retire, and making him empty his bladder then; in eliminating from his diet indigestible food, which might make him restless at night, and especially fermented liquors, if he has been accustomed to them; in promoting his general health by every means; ascertaining whether or no he is troubled with worms; if the urine be unduly acid, and the like. Secondly, by administering, before all things, belladonna. This agent has the power of paralyzing the muscular fibres of the bladder; hence its bad effect in some cases of weak bladder in elderly men. By its means we can effectually antagonize the hyperactivity of the organ in these children; and, having paralyzed it more or less during a period of two or three months, the habit of retention is acquired, and the incontinence does not reappear, or only to a slight extent, when the medicine has been discontinued. It is rare for belladonna to fail, if it be administered in sufficient doses, and its influence be maintained for a sufficiently long period. I give it thus: a child, say of eight years old, should commence with ten minims of the tincture in water, every afternoon, and at bed-time; after four or five days, the dose should be increased three or four minims, and so on, after similar terms, until it reaches at least thirty or forty minims twice a day. If no great inconvenience is experienced by this quantity, the dose may be again gradually and steadily increased, and a couple of months or so may pass before the maximum has been attained; and, if manifest improvement results, it should be continued, and finally gradually diminished, until one nightly dose only is required. I am never satisfied that it is desirable to employ any other agent until belladonna has had such a trial as this just described. That having been done, and without benefit, other remedies may be enumerated, as follows: the addition of the tincture of the perchloride of iron, or steel wine, to the belladonna; the addition of strychnia, say $\frac{1}{30}$ of a grain, to each dose; for patients arriving at the age of puberty, the passing of a soft bougie every day, or alternate day, for a short time; the cauterization, five and ten grains of lunar caustic to the ounce of water, of the urethra and neck of the bladder; at any age the operation of circumcision, if there is a preternaturally long prepuce, or if congenital phimosis exists. For town-bred children, a wild life, during an entire summer, on Welsh or Scotch hills, pony-riding, and physical exercises of all kinds, with very little intellectual training, I have found successful in some notable cases, which had resisted all other treatment.

Retention of urine has been referred to above, and of course implies surgical treatment. *Atony*, and *over-distension of the bladder*, are among its causes in adult patients. This condition not unfrequently follows a prolonged voluntary retention by a patient who had been in circumstances in which he was unable to comply with pressing wants to micturate, and while regarding the symptoms met with in all these cases, it is never to be forgotten that *involuntary micturition indicates retention, and not incontinence.* There are a few exceptions to this rule, but very few. Hence, when the adult patient complains that urine escapes, either at night, or when making muscular efforts, without his ability altogether to control it, absolute necessity exists that his bladder should be explored by a catheter immediately after a voluntary act of micturition, in order to ascertain if any urine remains behind which by his own

efforts he was unable to pass. That being so, to the extent of two or more ounces, as a rule the mechanical emptying of the organ every day is the essential treatment, if the patient is to regain the natural power, and maintain his urinary organs in a healthy state in the future.

Paralysis of the bladder gives rise to similar phenomena. By this term is not intended the incompetency already described, nor the inability to void urine which occurs from hypertrophied prostate, although the term is frequently applied, most unwisely, to both those conditions. Paralysis being logically only applicable to the result of lesions in the cerebro-spinal system, that incompetency on the part of the bladder, either to retain or to expel its contents [almost always the latter], which is due to such lesion, is alone so designated here.

No specific medical treatment, as regards the bladder, can be advised. In these circumstances a bladder which does not empty itself, must, before all things, be emptied by the catheter. Meanwhile the medical treatment of the central lesion will be determined by the entire group of symptoms, and the patient's general state, and will be pursued accordingly.

Neither can any medical treatment be suggested for any of those *organic changes* which affect the bladder, the existence of which may not be overlooked in diagnosing any urinary affection, and which may be enumerated as follows: hypertrophy of the muscular coats of the bladder, most commonly resulting from prostatic obstruction, or stricture of the urethra; sacculation of the mucous membrane, occasioned by its being forced between the crossing fasciculi of the muscular coat, so that cavities are formed, capable of holding from one to fifteen, or even twenty, ounces of urine. The bladder is also the seat of villous growth, occasioning prolonged and considerable hemorrhage; of epithelioma; of true cancerous formations; and, very rarely indeed, of fibrous polypoid growths.

For the significance of bleeding, from these and many other sources in the entire urinary system, a phenomenon broadly spoken of as Hæmaturia, the reader is referred to the article on that subject.

DISEASES OF THE FEMALE REPRODUCTIVE ORGANS.

A. Uterus.
Changes in Form and Position.
Disorders of Function.
Inflammation.
Growths.

B. Periuterine Hæmatocele.

C. Pelvic Cellulitis.

D. Ovaries.
Inflammation.
Growths.

CHANGES IN THE SHAPE AND POSITION OF THE UTERUS.

By Graily Hewitt, M.D., F.R.C.P.

Introductory Remarks.—The system of uterine pathology which the author has advocated[1] imputes to alterations in the shape of the uterus, a very prominent place, change of shape of the uterus being considered to have a very important effect in causing or intensifying certain other morbid conditions of the organ in question with which it is frequently associated.

These alterations in the shape of the uterus which have of late received renewed attention, and which have been further carefully studied by several observers of eminence, can no longer be placed in a subordinate position in any system of uterine pathology professing to be in conformity with the present state of knowledge. The clinical evidence of the close relation subsisting between these alterations of the shape of the uterus and the various troublesome symptoms and discomforts experienced by those who are the subjects of them, is too strong to be any longer disregarded. The uterus is undoubtedly liable to *functional* disease, and such functional disease may exist by itself. But it is also liable to what may be termed *mechanical* disease, and that to an extent which has not until of late years been suspected. Many of the cases of so-called functional disease turn out on investigation to be cases of mechanical disease, and the question now, so often debated, is how much of the disorder present is functional, or how much merely mechanical. Thus amenorrhœa, menorrhagia, dysmenorrhœa, were, until lately, looked on as almost exclusively functional diseases, a view which can no longer be maintained. Again, the conditions hitherto denominated "inflammation" and "congestion" of the uterus, and which have been regarded as substantial diseases, can be shown to be largely dependent on mechanical changes in the shape and position of the uterus. How much of the congestion or (so-called) inflammation is due to these mechanical changes is matter for important debate, and in point of fact, where differences of opinion prevail, it is principally as to the *primary* part played by the one or the other of these two elements in the case.

It is certain that *the condition of the tissues* of the uterus is matter in all cases for separate, careful consideration. The relation of these tissue changes to the mechanical diseases is one of the utmost practical importance, and, in the author's view, this relation demands the most careful study and attention. Tissue changes themselves, constitutional in nature, do in fact frequently cause or predispose to various mechanical diseases of the uterus, and these mechanical diseases in their turn intensify the effects of the primary tissue changes. Further than this, the mechanical diseases themselves produce tissue changes peculiar and characteristic.

It is obvious enough that physical changes in the tissues of the uterus will be liable in a very important manner to predispose to the occurrence of such alter-

[1] Diseases of Women, 3d edit. 1872.

ations as those we have now to consider and describe. Hitherto little attention has been bestowed on the etiology of uterine distortions, because the distortion has been looked upon as unimportant. Moreover, concurrently with the revival of attention to these distortions, the unsatisfactory character of the "inflammatory" theory of uterine disease has become more and more evident. The tissue changes in the uterus so long described as "inflammation," "chronic inflammation," &c., can be shown to be susceptible of less recondite and more intelligible explanation.

Congenital Deformity, or Defective Development of the Uterus.

Rudimentary formation.—Complete absence of the uterus is rare. Rudimentary formation is occasionally witnessed; the uterus may be the size of a pea or even smaller. Conjoined with this the vagina may be also rudimentary. The external organs may be apparently normal.

Infantile Uterus.—At puberty no further increase in size occurs. Conjoined with this the uterus may be abnormal in other particulars or not. The os may be imperforate. In a few cases further development occurs later on.

Uterus Unicornis.—The uterus is divided above into two cornua, one of which is well developed; the other small and rudimentary.

Double Uterus.—Of this there are several varieties. The separation may be entirely complete, even involving the vagina, each uterus having a separate vagina. The uterus may be externally apparently single, but completely divided into two internally by a septum, or this internal septum may only extend partly downwards. There are other variations. (*See* Kussmaul, *Von dem Mangel, der Verkümmerung und Verdopplung der Gebärmutter*, Würzburg, 1859.)

Distortions of the Uterus.

Distortions of the uterus include—*a*. Flexions; *b*. Inversion of the uterus, partial or complete; *c*. Elongation.

When the uterus is bent forwards so that the uterine canal is curved, the concavity looking forwards, it is said to be *anteflexed*. The reverse condition is *retroflexion*. In some cases there exists *lateriflexion*, together with some degree of ante- or retro-flexion.

Retroflexion as a distinct disease has been long recognized. But anteflexion has scarcely as yet, unless where the flexion is extreme in degree, been admitted to its proper rank as a definite and distinct affection. The reason for this omission is the circumstance that the uterus is normally slightly bent forwards, and the precise line of demarcation between normal and abnormal inclination forwards has not been accurately defined.

In general terms it may be stated that distortions of the uterus almost invariably give rise to discomforts or actual pains, which discomforts and pains are particularly produced by motion (uterine dyskinesia), and not unfrequently to such a degree that the patient is completely invalided, that they generally materially interfere with the due performance of the functions of the uterus, giving rise not seldom to dysmenorrhœa, or menorrhagia—often preventing conception and frequently occasioning abortion; that the various morbid conditions of the uterus, congestion, enlargement, and so-called chronic inflammation of the organ are commonly associated with these distortions, and that the secretions of the mucous surfaces of the uterus are liable to be much increased and altered in character in cases where distortions are present. They, at the same time, give rise to various mechanical disturbances in the adjacent organs—the rectum and bladder—occasioning difficulty in defecation, and in various ways disturbing the performance of the functions of the bladder.

Distortions of the uterus are of necessity associated with alterations of *position* of the organ—a common condition present is descent of the body of the uterus or fundus uteri in the pelvis. In cases of anteflexion, the descent of the fundus is to some extent limited by the bladder and other anterior connections of the uterus, and the dislocation of the fundus is not so considerable as in cases of retroflexion, when the fundus may be found to have descended almost to the rectal aperture.

Etiology.—Distortions of the uterus most frequently occur slowly, the degree of the distortion being at first slight, and increasing gradually; but they may originate in an acute form.

The *predisposing causes* deserve a careful attention. They include all circumstances which may weaken that inherent power which the healthy uterus possesses of resisting any attempt at alteration of its shape. The healthy uterus maintains its shape partly by the aid of its ligaments and general connections, but mainly, it may be said, by virtue of its own thickness and the resistance of its tissues. In point of fact, the heavier part of the uterus, that is to say, the fundus, has, practically speaking, no fixity, and were it not for the rigidity of the uterus itself would be readily bent backwards or forwards. The uterus in the healthy state

has, as regards its centre, but little motion; the chief attachments of the organ surround it at this situation and prevent extensive movement. The centre of the uterus may be considered as an axis of rotation, the fundus being allowed to move backwards or forwards to some extent and the cervix uteri also participating in this motion. Probably the normal rotating motion of the uterus does not exceed a quarter of a circle, this being taken to represent the distance between extreme anteversion and retroversion. Further, in practising these evolutions it is to be understood that the uterus moves as a solid rigid body, and that it actually bends but little in the process. Probably a certain amount of bending-over actually occurs in individuals in a state of health during these normal movements of the fundus uteri backwards or forwards as the case may be, but then a rebound occurs and the organ returns to its original position and shape when the force producing the disturbance is no longer in operation.

Congestion of the Uterus.—Congestion of the uterus is a condition doubtless predisposing to the occurrence of flexions. But as will be presently shown (see p. 754) congestion of the uterus is properly speaking an effect rather than a cause of alteration in the shape of the organ. See also succeeding remarks on Mal-nutrition of the Uterus.

Mal-nutrition of the Uterus.—In common with other organs of the body, the uterus is liable to suffer from defective nutrition of its tissues. So well marked are the clinical features of cases of this kind, and so important are they in their various bearings, that it is deemed necessary to direct special attention to this subject.

This condition of the uterus is characterized by *unusual softness* and *want of firmness of the whole organ*, plainly recognizable by the touch so far as the cervix is concerned, and as regards the body of the uterus rendered evident by other facts of the case. The bulk of the uterus is less than usual, unless, as is not rarely the case, congestion be superadded. The softness of the tissues of the uterus may be so extreme that to the touch the vaginal portion feels almost as soft as in the latter months of pregnancy, instead of presenting the firm resistant feel of the healthy uterus.

Cases of mal-nutrition of the uterus present themselves in their most typical form in young women between the ages of sixteen and eighteen, and always in cases where there is abundant evidence of weakness and previous defective nutrition of the body generally. This condition may probably also be induced by the prostrating effects of severe fevers. The cases here alluded to include those described by Sir J. Y. Simpson as cases of super-involution of the uterus, but these latter cases occur in women who have borne one or more children.

The rapid development of the genital organs which occurs normally on the arrival of puberty demands a free and full supply of nourishment. In some rare instances, as is well known, the uterus never does attain its full development, the retardation probably being due to other causes; but this class of cases differs from those now under consideration. Here, we have the uterus fully developed and of the normal length, but its tissues are abnormally soft. From the circumstance that this is observed in association with great general weakness, the inference is obvious that the condition of the uterus is one of mal-nutrition. The clinical history of such cases and the results of treatment give the fullest confirmation of this view.

The undue softness of the uterine tissues reveals itself in the liability of the patient to suffer from flexion of the organ. Exertions of various kinds readily displace the uterus and distort its shape, and the suffering produced by this change of shape may be the first indication that the uterus is in any way affected. The uterus may retain its proper shape if circumstances are favorable, and with returning health and vigor of the system generally the uterus becomes also healthy. But undue, or even ordinary, exertions tell with unfavorable effect in many cases, and the softness of the uterine tissues paves the way to other disorders.

Young women presenting this condition feel a difficulty in walking more than a very short distance without discomfort (uterine dyskinesia). They suffer frequently from a feeling of nausea on rising in the morning, often persisting during the day or induced by exertion. They present various so-called "hysterical" symptoms. They are considered "delicate," perhaps whimsical, and the indisposition for exertion is not seldom regarded as a mental rather than a physical disturbance. The sympathetic effects on the stomach consist in anorexia, tendency to nausea or vomiting; the quantity of food taken daily becoming less and less, the patient eventually falls into a state of semi-starvation. The uterine malady is thus perpetuated, and the tissues of the organ lose still further their normal tone and firmness. The uterus fails to perform its functions properly, and dysmenorrhœa or amenorrhœa in various degrees of intensity may be observed. In a few cases severe menorrhagia occurs, of which the writer has seen two or three very notable instances.

Following the occurrence of this softness of the tissues of the uterus, in many instances there is observed later on a

chronic, well-marked distortion of the shape of the uterus, with atrophy of the uterine wall at the centre of the organ, usually the part where the flexure occurs. But it is to be remarked that when the flexion is well established the softness may have quite disappeared. This point will be further considered later on.

Undue softness of the uterus, persisting only for a few weeks, may have no permanently injurious effect. But continuing for some months or longer, it rarely fails to lead to some such alteration in the shape of the organ, as to entail more or less permanent disability of various kinds. Locomotive power is apt to be most seriously interfered with.

Women who have had children, or who have been pregnant, may become of course the subjects of malnutrition of the uterus. In such cases the uterus is not only soft but it is generally larger than usual. Imperfect involution of the uterus is frequently due to defective nutrition of the organ. The tissues do not contract, the organ is large, soft, and unwieldy, and is very much at the mercy of external forces. The great size and softness of the uterus render its distortion and displacement a matter of ease. Miscarriage after miscarriage is not seldom a consequence, the uterine walls appearing to have more or less completely lost their rigidity, and in some cases they may be so soft that it is even difficult to define by the touch the outline of the organ.

Clinical observation has led to the opinion here expressed that undue softness of the uterus is mainly due to malnutrition of the organ. The softness may be due either to feebleness and imperfect development of the muscular elements in the uterus, or to a deranged nervous action, or to deficient circulatory power and lessened blood supply, or it may be due to all these causes conjoined. It might be described as "atonicity" of the uterus but for the fact that the well-nourished uterus may fall into an atonic state; mere softness does not necessarily imply mal-nutrition, for the healthy uterus undoubtedly undergoes changes in regard to hardness and softness under certain circumstances. The dilatation of the cervix uteri by a tent, for example, produces a quite remarkable softness of the tissues of the os uteri. Further, contractions and relaxations of the uterus are now pretty generally admitted to occur during menstruation, especially in cases when dysmenorrhœa is observed, and under these circumstances alternate hardness and softness of the uterine tissues might be detected.

General weakness must be set down as a predisposing cause of uterine distortion, whether that weakness proceed from a general feebleness consequent on a long course of imperfect nutrition of the body, or be due to the effects of fevers or other prostrating diseases. Some of the most troublesome cases of uterine distortion have plainly their origin in this way; after some weeks or months of debilitating illness, from scarlet fever for instance, the patient begins to move about, and whether from the feeble resistance of the uterine tissues themselves, or the weakened condition of the uterine attachments, one or both, mechanical mischief results and uterine distortion is originated.

Sub-involution of the Uterus.—This is a most important condition in regard to the etiology of flexions of the uterus. The uterus increases considerably in weight and size during pregnancy. Thus when pregnancy is at an end, and the uterus is completely emptied of its contents, the organ is thicker, heavier, and very much larger than usual. Involution of the organ, as it is termed, follows, and in a few weeks the uterus regains its previous size. Such is the normal course. This course is frequently disturbed, the uterus failing to undergo its proper reduction in size. The term sub-involution, first employed by the late Sir J. Y. Simpson, is now generally employed to designate such cases.

Sub-involution of the uterus is a frequent concomitant of abortion, as well as of deliveries at full terms. The causes of sub-involution of the uterus are general and local. The *general* causes are *great debility*, in consequence of which the nutritive changes which should proceed rapidly in the uterus are retarded or impeded. Weakly women are peculiarly prone to suffer from sub-involution. Any *general* or *constitutional disease* may give rise to it. The *local* causes are frequently mechanical in their action. Thus the normal involution is often retarded by alterations in the shape of the uterus, resulting from strains and undue exertion too quickly following labor. The distortion impedes the circulation and the nutrition process is disturbed. The sub-involution is not uncommonly the primary cause of the alteration in shape, as when a patient six weeks after her labor, with the uterus in a state of sub-involution due to general debility, takes a long walk, produces thereby a distortion in the shape of the uterus, and two or three months later, perhaps, is discovered to have a large retroflexed or anteflexed uterus. Here the sub-involution has a primary as well as a secondary cause.

In the list of local causes must be mentioned previous distortion of the uterus, for a long standing distortion frequently recurs after pregnancy is over, and such recurrence may act very powerfully in retarding uterine involution.

Puerperal fever, now more correctly designated puerperal septicæmia, may produce sub-involution of the uterus. Observation has convinced the author that involution is at once arrested by the existence of puerperal fever, one of the first effects being apparently a paralysis of the muscular fibres.

Sub-involution of the uterus is, not unfrequently, either directly or indirectly, the cause of other diseases of the uterus; many troublesome cases of menorrhagia and leucorrhea have their origin therein. Prolapsus and change of form of the uterus are frequent effects. Chronic hypertrophy of the uterus is the result in many instances. Disorders of micturition and defecation may also result from the increased weight and bulk of the organ.

Congestion of the uterus is frequently associated with sub-involution. In fact both conditions are frequently traceable to the same cause—general debility. And when distortion is superadded to sub-involution, the congestion is liable to be of an extreme character.

Laceration of the perineum is a most important predisposing cause of uterine flexion and displacement. The floor of the vagina is thus diminished in area and thickness. Perineal deficiency most frequently tends to give rise to the anterior descent of the fundus uteri; the bladder first descends, and this is followed by the uterus. The tendency is thus to the production of anteversion and anteflexion, and severe degrees of anteflexion coupled with cystocele are sometimes met with in cases of extensive injury to the perineum, the result of labor. More rarely retroflexion and perineal deficiency are found associated.

An important predisposing cause, is alteration of the position of the uterus as a whole. The uterus as a whole has certain normal movements irrespective of alterations in the direction of its axis, or of alterations in its degree of curvature, viz., movement forwards or backwards, and upwards and downwards. And there can be no doubt, that when the normal movements in these directions are exceeded, this circumstance favors a change of shape of the organ. Abnormal mobility of the uterus thus constitutes a predisposition to change of the shape of the organ. Pregnancy is apt to leave behind it, especially in weakly individuals, an abnormal loosening of the general connections of the uterus. Then the uterus falls as a whole too low, or moves too far forwards or backwards, and when thus removed from its proper position in the pelvis, it is more liable to be bent, should a force capable of causing a bending be brought into play.

Exciting causes.—Decided flexion of the uterus may be produced in what may be termed an *acute* way. Various accidents, principally those which give rise to a sudden jar or shake of the whole trunk of the body, may give rise to it. The following are instances: A young lady is rolled over and over in a railway carriage down an embankment; a young woman in a spirit of bravado carries a heavy weight across the room; or, while standing at a horse's head, the animal suddenly breaks away and drags her along the ground; or coming down stairs the foot slips and she slides down several steps, the lower part of the spine being brought into violent collision with the edges of the steps; or walking in the streets she suddenly slips upon a piece of orange-peel; or unaccustomed to horse exercise, she rides on a hard-mouthed spirited horse; or walks for several hours consecutively in a mountainous country, having been unaccustomed previously to take long walks; or at a gymnasium she practises jumping down from one elevation to a considerably lower one. These are actual instances of acutely and suddenly produced distortion of the uterus occurring in tolerably healthy and previously sound individuals, who became thereupon completely laid up and incapacitated from the event in question. Many other similar histories might be quoted.

But it frequently happens that the distortion originates in a less acute manner, and in consequence of the continued operation of a less powerful exciting cause. Of these cases the following may be cited as instances:—

A young woman not particularly strong, engages in an occupation requiring prolonged standing, or too frequent lifting of heavy bodies. A young lady at school, and not sufficiently fed, is made to take long walks. A patient recently recovered from a long illness, is allowed to take too vigorous exercise. Numberless instances of this kind might be quoted, but they resolve themselves usually into a combination of the two conditions: (1) a rather undue weakness of the uterus or its supports, and (2) a slight, but continually acting force compressing the pelvic viscera from above, and having the result that, more or less speedily, the fundus uteri is pushed forwards or backwards, or laterally as well as downwards, and thus distortion is produced.

And it is not very uncommon to meet with very considerable and serious flexions, ante, retro, or lateral, in patients who have never suffered from any severe physical shock or accident. In such cases, the tendency is to assume that the condition is congenital, but a considerable congenital flexion appears really to be one of the very rarest of events, and the explanation of the condition will usually be found if a careful investigation of the previous history of the patient be made.

Here it seems proper to state the result of the author's observations, that certain physical exertions would be wisely avoided by all but very robust young women, such as riding on horseback, taking long walks (over an hour at a time being considered "long"), violent gymnastic exercises, &c. And clinical facts show that young women previously in robust health, are liable to be seriously damaged by such exercises.

Complications and effects.—It will be convenient to consider the complications and effects of flexion of the uterus under one head, inasmuch as opinions would be divided as to the proper use of the term "complication" or "effect" in certain instances. One important complication is the change in the *position* of the uterus. Flexion of the uterus of course implies a certain change in the position of the fundus uteri. The uterus does not undergo a change of position *as a whole* in consequence of such flexion. And *vice versâ*, the uterus may have its position very much changed, quite irrespective of the occurrence of flexion. As a matter of fact considerable degrees of flexion are generally associated with very considerable degrees of lowering of the uterus, and descent of the whole organ towards the floor and outlet of the pelvis. This subject, which is one of very great importance, will be found discussed separately further on.

Congestion of the Uterus.—The relations of congestion of the uterus to flexions of the organ are most important. Congestion may be both a cause and an effect of flexion of the uterus. It will be convenient in this place to consider congestion of the uterus from a broad point of view, and to explain the general relation subsisting between this condition and the various distortions of the uterus.

Undue fulness of the bloodvessels of the uterus is a condition frequently met with. The uterus is a very vascular organ, its texture, notably as regards the body of the uterus, although firm, might be almost described as spongy, and the interspaces, so evident on section to the naked eye, are susceptible of considerable distension with blood. In fact the structure of the organ, and its extensive blood supply, predispose it to the occurrence of congestion.

General congestion of the uterus is probably present to a certain extent during menstruation, as first insisted on by Rouget, the organ being then fuller, heavier, and more bulky than usual. It does not follow from this that menstruation is caused by the congestion thus occurring. Dr. John Williams, who has recently devoted much attention to this subject, considers, indeed, that menstruation is not in any way dependent on congestion of the uterus. Congestion of the uterus is probably also present during sexual congress. Congestion of the uterus in an acute form probably occurs in cases where menstruation is suppressed from external application of cold, standing in wet, &c., possibly also from emotional disturbing influences. In a more gradual, slowly induced manner, general congestion of the uterus may be produced by an immense variety of causes. In all cases of general weakness or debility, when the blood current is slow and the circulation feeble, in cases of disease of the heart, of the liver, of the digestive organs, in cases of great debility following attacks of fever of various kinds, in cases when the uterus itself has undergone considerable draining of blood from its interior—in all these cases chronic general congestion of the uterus may be present to a marked degree.

Sub-involution of the uterus following on child-birth or miscarriage is very frequently associated with congestion of the organ, and in fact in many cases the congestion is the principal and prominent condition then observed.

Considerable increase in the bulk and weight of the uterus are necessarily accompaniments of its congestion. Very important dynamic results may ensue from this increase in size and weight, for it so happens that the body of the uterus, which is the part of the organ most affected by such congestion, increase of size, &c., is the part least capable of preserving its proper position and relations under unfavorable circumstances.

Coupled with this general congestion of the uterus we find frequently undue softness of the tissues. Not always so, however, for when the congestion has lasted a long time the uterus may become harder than usual; the congestion is exchanged for hardness and increase of size. The previous remarks apply to the general causes of congestion of the uterus. But it appears that in a very considerable number of cases congestion of the uterus is due to a change in the shape of the organ. The explanation of this occurrence is sufficiently simple. The bloodvessels of the uterus, for the most part, enter and leave it about the centre of the organ, passing from this central situation upwards to the fundus and downwards to the cervix. The two extremities of the uterus are, moreover, comparatively free and unattached. Any compression of the central part of the uterus, that is to say, at or near the situation of the internal os uteri where the body of the uterus joins the cervix, is thus attended necessarily with an obstruction to the flow of blood to and from the cervix uteri at its lowest part. Hence, when the uterus becomes bent, an obstruction in the circulation in the organ may occur, and congestion ensues at one or both extremities of the uterus. This mechanically produced con-

gestion may affect the fundus exclusively or the vaginal portion of the uterus exclusively, according to the precise seat of the flexion. Some few years ago, the author described the pathological congestion so occurring as "strangulation" of the uterus. Klob had, it appears, previously, though this was then unknown to the present writer, alluded to the influence of flexions in producing congestion of the uterus. Dr. Gaillard Thomas, also considers this as an important etiological element. The effect of an acute flexion of the uterus is, indeed, so far as the circulation is concerned, nearly the same as would be produced if a ligature were placed round the uterus at its middle, not sufficiently tight to close the arterial, but enough to materially retard the return through the venous current. A due recognition of the influence of flexion of the uterus in thus producing congestion, is essential to a complete understanding of the subject.

A general result of congestions of the uterus is *increase in size and weight*, due, at first, to the increased quantity of blood in the tissues, but, in chronic cases, to actual increase in the quantity of solid constituents. Various terms are employed to designate this condition. It is essentially an hypertrophy. The term "chronic inflammation" conveys a wrong impression, and is discarded by several writers of eminence. Dr. Gaillard Thomas terms it "Areolar hyperplasia." "Congestive hypertrophy," would, having regard to its etiology, perhaps more correctly designate the condition in question.

In cases of "congestive hypertrophy," the tissues are at first softer than usual. They end often by becoming very much harder than usual, and when the organ has become altered in shape, as is not uncommonly the case, we have a combination of extreme hardness with distortion of shape and increase of size, the increase in size—congestive hypertrophy—affecting the fundus alone, the cervix alone, or both conjointly.

Congestive hypertrophy of the cervix, when giving rise to much swelling of this part produces a very open condition of the os uteri externum. The surface of the os uteri may also be extremely vascular, and present those various appearances formerly described as "ulcerations." It is well known that these so-called ulcerations attracted at one time well nigh the whole attention of uterine pathologists. The extreme vascularity of the mucous membrane lining the cervix and the abrupt line of demarcation presented between this and the adjacent mucous membrane covering the lips of the os uteri, appear to have given a false impression, the abrupt line of division having been probably taken to be the edge of an ulcer in many cases. The natural shape of the os uteri is rarely preserved in a long-standing case of congestive hypertrophy of the uterus.

Congestive hypertrophy in its early stage—that of softness—is often associated with mal-nutrition of the organ (see *ante*, p. 751). It is not seldom a sequel of defective involution after labor.

Congestion of the uterus may be *acute* or *chronic*. An intense form of acute congestion is witnessed in severe flexion of the uterus. The more severe forms of chronic congestion are observed in association with defective involution following delivery. An acute attack has a tendency to become chronic, and the chronic form is liable at any moment to become acute.

Probably a useful distinction might be drawn between *active* and *passive* congestion of the uterus. Thus, active congestion might follow a chill; passive congestion would result from a flexion of the uterus. These may be mentioned as typical events.

Disturbances of Functions of the Uterus.—A very common effect of flexion of the uterus is obstruction to the catamenial flow. Many of the most severe cases of *dysmenorrhœa* are directly due to the constriction of the uterine canal at or near the internal os uteri which the flexion produces.

A further not very uncommon effect is retention of uterine discharges within the cavity of the uterus. Puriform or semi-purulent fluids retained in the uterus escape from time to time in gushes, sometimes accompanied by pains not unlike dysmenorrhœal pains. Endometritis is the natural result of this condition, and the uterine cavity becomes not only irritated, but distended by the retained fluid.

Leucorrhœa, due to increased cervical secretion, is common in cases where flexion *plus* congestion exists.

Menorrhagia is a rather frequent accompaniment. It is partly due to the obstructed flow causing accumulation in the uterus and distension of that cavity, and partly to the unusual congestion present. The loss of blood arising from flexion is sometimes very great.

Increase in the size of the uterus is a further effect observable in chronic cases. The two extremities of the uterus—the fundus and the vaginal portion of the cervix—more commonly exhibit this effect. A large hypertrophied nodular condition of the vaginal cervical structures is witnessed in some long-standing cases. And the body of the uterus is similarly hypertrophied still more frequently.

Atrophy of the uterus is sometimes observed. More commonly, however, the atrophy is localized, and affects that part of the uterus only at the seat of the bend.

It would appear that the thickness of

the cervical canal is sometimes so materially reduced by the long continued pressure to which the tissues have been subjected that the wall is only the thickness of paper. This is liable to occur particularly on the concave side of the bend. But this atrophy is not a constant effect, nor is it constantly present on the concave side. As a matter of fact the thickness of the wall is sometimes even increased at this point, and the author has had occasion to observe an actual bulging at this situation on examining the outline of the uterus digitally. This local atrophy is a very serious obstacle to a perfectly successful curative treatment in long-standing cases.

The painful sensations and alterations of sensibility due to flexions are numerous and highly important; but they will be more appropriately described under the head of "Symptoms."

General Remarks on Treatment of Flexions of the Uterus.—Here it will be well to point out the general principles on which the treatment of cases of flexion of the uterus should be conducted. More especially it is necessary to direct attention to those measures by which the various disordered conditions of the tissues of the uterus, which play so important a part in the etiology of flexions, may be remedied and prevented. Special appropriate treatment is required for various cases, but the general treatment is of exceeding importance, and mere mechanical treatment will lead but to poor results, unless due attention be paid to the amelioration and improvement of the general condition of the patient, by which latter means alone we can hope to satisfactorily influence the nutritional changes going on in the uterine tissues.

When softness, due to *mal-nutrition of the uterus*, is present, as is very frequently the case, the remedy is obvious. Food is required. Great difficulty may be experienced in administering it owing to the nausea, feebleness of stomach, and other causes. For such patients abundance of fresh air is very necessary, but the recumbent position during the greater part of the day is almost essential. A gentle walk may be allowed in some cases, but all violent exercises, such as riding on horseback and carriage exercise over rough roads, must be forbidden. It is found that patients eat best who follow this rule. The sympathetic nausea is thus prevented. Animal food given frequently, in small quantities, at first in form of soups or essences, afterwards in the solid state, succeeds best in restoring the firmness to the uterus. But many months may be required to effect the object. Baths, frictions, tonics of various kinds, change of air; whatever, in fact, tends to help the restoration of the general health will be serviceable.

In cases where *sub-involution of the uterus* is present, means must be adopted to hasten and promote the contraction of the uterus. When the form of the uterus is unaltered, ergot, tonics, and a thoroughly nutritious dietary will be found effectual. When the uterus is altered in shape mechanical treatment may be required, and is indeed imperative in some cases. The occasional straightening of the uterus by means of the sound, associated with maintenance of the dorsal position in anteflexion cases, or the semiprone position in cases of retroflexion, will powerfully assist in the restoration of the uterus to its proper size and shape. Pessaries are requisite in some instances, and when the distortion and associated sub-involution are of long standing, they are indispensable. Whatever tends to promote healthy circulation in the uterus acts favorably in reducing its size. Warm injections containing Kreuznach salt in solution are beneficial.

The general Treatment of cases where Congestion is present.—Attention to the general health is of the utmost importance. When the uterine congestion arises from a general sluggish circulation, or from a general mal-nutrition, or from a special uterine mal-nutrition; under these circumstances no progress can be made unless the greatest care be taken to strengthen the patient. Much rest, fresh air, highly nourishing food, baths, frictions of the skin, change of scene, ferruginous tonics—these are powerful remedies if they are judiciously applied. In some cases the fundamental general weakness is such that a year or two of such treatment is required to restore to the patient an average strength. These are cases requiring emphatically a "bracing" system, as it is termed. But this bracing system must be applied with discrimination. Such feeble ill-nourished patients are not fitted to undertake long walks, or to ride on horseback, or to get up early in the morning, or to sit in the ordinary position for any length of time. Mischief of an almost irreparable kind is not seldom done by want of consideration in recommending some of these exercises and supposed aids to the recovery of health. The constitution and peculiarities of women are such that these vigorous procedures are not tolerated, and a chronic distortion of the uterus is liable to be the result of such injudicious recommendations. The amount of exercise should be limited, but the patient should be as much as possible in the open air.

Aperients are more or less necessary, for absence of exercise tends to produce constipation and inaction of the liver. Castor oil taken in doses of a teaspoonful

daily is a valuable medicine. Enemata, daily, are better suited to some cases. Some of the foreign mineral waters, as Friedrichshall or Pullna, &c., are often useful. And it is well to give occasionally a moderately strong dose of some cholagogue medicine. Even small doses of blue pill are required in certain instances. Constipation must at all costs be prevented.

Rest.—One of the most powerful agents in the general treatment of flexion cases is "rest." This has been long known and acted on to a great extent. The horizontal position gives rest to the body generally, and also to the uterus, and when—as is most commonly the case—it is a very important object to prevent the further downward movement of the fundus uteri, the horizontal position is a great assistance. For cases of simple congestion, for cases of general or local mal-nutrition, when the uterus has not yet become decidedly distorted, this kind of rest for the uterus may be all that is required.

ANTEFLEXION OF THE UTERUS.—The uterus has normally a slight anterior concavity as regards its canal. The degree of the normal bend forwards has been the subject of much controversy. It appears that it is more pronounced just before puberty than afterwards, and that the normal healthy development of the uterus involves a considerable straightening of the canal. It follows that if circumstances retard this healthy development, the anterior bend will continue to be too pronounced after the age of puberty has been reached.

Anteflexion of the uterus exists in all degrees. In slight cases the two canals of the cervix and of the body of the uterus would be represented by two lines meeting at an angle of more than 90°. When severe the angle may be considerably less than a right angle, the organ being literally doubled upon itself. The curve actually formed is generally a parabola, or approaches thereto more or less closely.

Associated with anteflexion, there is usually a more or less considerable degree of anteversion. The os uteri approaches the centre of the sacrum while the fundus approaches the triangular ligament. There are infinite varieties in this respect. Simple extreme anteversion is rare. Further there is in many cases another very important change, viz., descent of the uterus as a whole, the organ presenting, not rarely, the three conditions, descent, anteversion, and acute anteflexion. Until these several elements are recognized, and their several degrees ascertained, the diagnosis cannot be said to be complete.

There is one peculiar variety of anteflexion, which consists in a simultaneous acute anteflexion with descent of the organ, and retroversion instead of anteversion. In this latter case the vaginal portion of the cervix points directly upwards and forwards; cases of this kind are extremely difficult to deal with successfully. Decided anteflexion with the uterus, as a whole, in its normal position is rare, but down it is sometimes observed.

Anteflexion of the uterus is a very common affection. In slight cases the real nature of the malady frequently escapes detection. In very severe cases it is not uncommonly overlooked, because no attempt is made to define the position and shape of the uterus by careful examination, or the presence of "displacement" being known, the importance of the distortion really present is underrated, the patient's symptoms and discomforts are not attributed to their real source, and a particular investigation of the case in this direction is never really undertaken. The principal explanation of this latter occurrence is the prevalence of what the author believes to be a completely mistaken idea as to anteflexion being a normal condition of the uterus. The normal anterior curvature is really very slight, and it is not accompanied with a descent of the uterus forwards and downwards, which in a greater or less degree characterizes this disease—for disease it most assuredly is.

It may be convenient to divide cases according to the degree of the flexion, into first, second, and third degrees. In the first degree the flexion is slight, in the third it is highly marked. In cases of anteflexion of the third degree, the body of the uterus is often not so low in the pelvis as in cases of the second degree.

In cases of anteflexion the uterus may be found soft and pliable from mal-nutrition, or large and soft, and pliable, from defective involution following abortion or delivery at term. Or it may be hard, the hardness being coupled with considerable increase of size, or with no alterations in this respect. There may be considerable congestion of the whole organ, or that congestion may be limited to the body of the uterus.

In women who have borne children, considerable anteflexion and anteversion are sometimes coupled with deficient perineal support, the perineum having been considerably lacerated during parturition. There may be also in such cases some degree of prolapsus of the bladder. The injury to the perineum in such instances, is the direct cause of the uterine displacement and distortion.

Symptoms.—These are not always characteristic as between this affection and other varieties of uterine distortion and displacement, but they are frequently so. *Frequency of micturition* is very commonly observed, constituting sometimes a symp-

tom most troublesome to the patient. In some cases it almost amounts to incontinence. This symptom arises partly from the uterus actually occupying the space in the pelvis devoted to the bladder, and partly from the actual irritation of the pressure of the uterus on the floor of the bladder. Sometimes it is the result of an actual cystitis set up by the pressure of the uterus and the general irritation it produces. Retention of urine due to anteflexion is not common. *Pain*, referred to the groin on one or other side, and *pain in the back*, are common symptoms. This pain is exceedingly variable in regard to its degree. It is not a constant pain, and frequently hardly amounts to pain. It is produced by certain exertions, or intensified by them: stooping, lifting, going up and down stairs, taking a long walk; these may any of them give rise to marked discomfort. Not uncommonly the patient describes it as a bearing-down sensation, and she frequently very exactly and vividly describes the painful dragging, pushing sensations which would be expected to be experienced under such circumstances.

Sitting, especially sitting forwards, is generally painful, though some patients find a kind of relief in this position when the malady is of long standing. Locomotion is a trouble, but patients can frequently walk a moderate distance; not unfrequently, however, walking is a real impossibility. In acute cases motion is not attempted, or if it be practised it is at the cost of great aggravation of the existing pain. Many patients are entirely incapacitated for this reason. They walk less and less, or perhaps, encouraged by their friends to persevere in the attempt to walk, a complete break-down ensues, and the patient becomes a chronic invalid.

Locomotive inability (uterine dyskinesia) is one of the marked symptoms of anteflexion of the uterus, but it is not characteristic of it, for other displacements of the uterus may give rise to this symptom in an equally well-marked degree.

Nausea, or nausea and sickness, are symptoms of very great importance. They are rarely absent. The nausea may be slight or severe. It is mostly observed on first rising in the morning, but frequently it follows any exertion. The mere sitting at table often induces it. In very severe cases it is itself a real disease, imperilling the very existence of the patient; and cases are now and then seen in which the long continuance of the malady has brought about a near approach to starvation—wasting and extreme feebleness from want of food. Clinical observation plainly shows that the nausea is increased by whatever increases the descent of the fundus uteri, and thus exaggerates the existing flexion. This symptom is not peculiar to anteflexion, but may exist in other varieties of uterine distortion.

Constipation frequently exists in cases of anteflexion, and it is not uncommon to find that very strong medicines are required to procure action of the bowels. The difficulty more particularly occurs when the uterus is a good deal anteverted as well as flexed, and it appears to be produced by the forcible pressure of the cervix of the uterus against the floor of the pelvis, and on the rectum.

Swelling of the hypogastric region, usually limited to one side, is a rather constant symptom. It is a tympanitic distension, slight in amount, but it constitutes a discomfort of which the patient very much complains. It is absent in the early part of the day, but appears later on. Many patients believe themselves to have an actual tumor at this situation. This tumefaction has been considered by many observers to be dependent on ovarian irritation, and it is not usually ascribed to the cause here indicated. However, observation completely bears out the truth of the statement. It is difficult to give a quite satisfactory explanation of the rationale of the occurrence of this swelling, but that it occurs in connection with uterine flexion, and particularly in connection with anteflexion, is undoubted. It is always, moreover, intensified or produced by such mechanical movements as would be likely to increase temporarily the existing distortion of the uterus, such as standing or walking, or sitting upright.

Hysterical phenomena are in numberless instances associated with anteflexion. It cannot be said that their presence is in any way characteristic of this particular flexion of the uterus, for hysterical phenomena are or may be observable also in cases of retroflexion. The relation of hysteria to uterine flexions will be considered later on.

Diagnosis.—A careful digital examination is necessary in order to establish the diagnosis. An examination can be made per rectum, and the position and outline of the uterus may thus be tolerably accurately made out in cases where a vaginal examination is not judged to be imperative, or where it is objectionable. This method of examination is of the greatest service in making what may be termed an approximate diagnosis. In cases where no objection to a vaginal examination exists, the use of the finger aided by the sound enables us to make a very exact diagnosis of the case. In cases of slight anteflexion the finger must be pressed upwards through the vaginal roof, in order to define the outline of the body of the uterus. Normally the finger should encounter no resistance in this position. In severe cases of anteflexion the fundus

can be felt and its breadth defined with the utmost readiness, and when there is also much anteversion the whole organ is found close to the floor of the pelvis. The size of the uterus is thus also accurately appreciated.

Cases of anteflexion may be confounded with fibroid tumor in the anterior wall of the uterus, a condition which may closely simulate it; the converse proposition equally holds good. Many cases of supposed fibroid tumor in the anterior wall are resolved by the use of the sound into cases of acute chronic anteflexion. When the flexion is not associated with anteversion the recognition of its existence is not easy. Unusual density of the cellular tissue above the roof of the vagina may hinder recognition of the outline of the uterus. And it must be borne in mind that the fundus is not as a rule quite in the middle line; there is frequently, indeed, a quite decided inclination to one side, although this does not, except in very rare instances, amount to lateriflexion. Lastly, the very peculiar cases of acute anteflexion, combined with retroversion, occasion some embarrassment in their diagnosis, for the fundus is of course not to be felt at all in front. The sound will be the means of resolving the doubt. The combined method of examination by the rectum and over the hypogastric region is often useful in the diagnosis of a doubtful case.

Prognosis and Treatment.—When the distortion is recent it is not difficult to cure. When it has become chronic, and the disorder is perhaps of some years' standing, the cure is not easy. The difficulty in chronic cases is very frequently enormously increased by the circumstance that the patient is profoundly affected with another disease, viz., general malnutrition. It is hopeless to endeavor to effect permanent alteration of the shape of the uterus until the general health is restored. All chronic cases are not of this character, for in some the patients have got over the general feebleness which really gave rise to the disease originally, and the uterus is hard and compact and very firmly fixed in its distorted condition. A chronic neurosis is established, and prolonged mechanical treatment may be required to unbend the uterus and to give it a more natural shape. There are cases of this latter variety which are almost impossible to cure completely in consequence of the tenuity of the uterine wall at the seat of the flexion. When the uterus has become much hypertrophied also this additional bulk is difficult to get rid of, and yet unless the weight of the fundus be lessened the disease will return after an apparently successful treatment.

In cases where the anteflexion is of recent occurrence, the flexion not severe, and the uterus as a whole not very low down in the pelvis, treatment such as the following may be sufficient: The patient must be ordered to lie down as much as possible; the sitting position must be studiously avoided; lifting, carrying, stooping, and muscular exertions generally to be forbidden. The general health may flag if the patient is kept indoors; but carriage exercise is injurious unless taken in a semi-reclining position, and a short walk is less prejudicial than a ride in a carriage over a rough road. Persistence in this kind of mechanical treatment —which it really is—is often efficacious. Care should be taken that the bowels be opened daily without straining, and means taken to produce this result. Sea-baths, sponging with warm sea-water, tonics, fresh air, good food—these are adjuvants in the treatment not to be neglected.

If, as is not seldom the case, the general nutrition is greatly lowered, all treatment will be useless until this fundamental defect be remedied.

When the case is of long standing such treatment as that described above will prove merely palliative. In the case of young or unmarried women we have before us a choice of evils. If no direct local treatment be applied the patient may lapse into a permanent invalid, and her whole future prospects are perhaps endangered, or she has to submit to a course of treatment which is naturally distasteful. Another view may be perhaps taken of some of these chronic cases, viz., that the patient may after a while lose the principal of her discomforts, and that she may become habituated to the malady. It may be difficult to decide abstractedly, but in actual practice the circumstances of the case are usually a reliable guide. Assuredly there are numerous cases which it is simply cruel to allow to drag on from year to year unrelieved simply because the patient being unmarried local treatment is thought objectionable. This extreme is to be reprehended equally with the other extreme of applying local mechanical treatment in all cases of anteflexion indiscriminately. For married women affected with severe and long-standing anteflexions, local measures are almost necessarily employed.

There are various methods of treating anteflexion of the uterus when local measures are thought advisable. Periodical straightening of the uterine canal by means of the sound associated with maintenance of the dorsal position answers very well up to a certain point. The employment of the stem pessary is from many points of view satisfactory, and in good hands safe; but it is difficult to manage, and is certainly not a plan to be employed indiscriminately. Permanently applied pressure upwards through the

vaginal roof offers another, and, for many reasons, a more generally applicable method of treatment, and it may be combined with occasional use of the sound. The author's "cradle" pessary, in some one of its various modifications, and carefully adapted to the peculiarities of the case, offers great assistance in dealing with cases of anteflexion, whether recent or of long standing; but care must be taken that the pressure is made sufficiently high up and above the point at which the bend occurs.[1] When the uterine tissues have become very hard and firm this kind of pressure, alone, is of little avail in remedying the distortion. A frequently repeated use of the sound, and bending the uterus the reverse way, is then necessary. In some cases the stem pessary alone will be efficacious. In certain cases, when other mechanical supports are not tolerated, a small perfectly round air-ball pessary, 1¾ inches in diameter, will be found extremely useful.

Cases are now and then met with in which the anteflexion has established a permanent neurosis, and at the most compressed part acute tenderness is found to be present. These very severe cases, a few of which the author has met with in practice, are particularly troublesome to deal with. But they are extremely instructive as throwing considerable light on the cause of the pain usually felt in cases of flexion of the uterus. In these particular instances the tenderness was limited to precisely one spot; whenever the sound passed a particular part of the uterine canal acute pain was felt. The condensation and compression of the tissues implicating the nerves of the part appeared to be the cause of the pain, and acting on this view of the matter bilateral incision of the canal at this situation was in some of these cases performed. Subsequently the canal was maintained in a dilated state by a stem pessary for a few weeks. The treatment was successful in removing this abiding pain.

The question as to the necessity for cutting operations in the treatment of chronic anteflexions is one of some importance, for there is no doubt that a bilateral incision of the canal in some cases is of benefit and an assistance in carrying out the straightening treatment. Hitherto this operation has been principally done with a view to cure the supposed stricture at the internal os, or lower down the canal, and very little has been said of the acute flexion, which usually exists in these very cases. This flexion has been either entirely overlooked or thought of no consequence. Hence the cutting operation has had a comparatively small success, the effects of the operation passing off in a few weeks, and the uterus left as impervious as ever. Those cases only have given great satisfaction when this cutting operation has been followed by a continuous dilatation treatment for some time. In fact the mere cutting is useless without this subsequent treatment. In the neurotic cases above alluded to the incision was valuable and useful; but it does not appear that, as a rule, it is a necessary procedure. The canal may be dilated with tents, and when sufficiently enlarged a stem pessary may be worn to maintain that degree of patency, and allowed to remain long enough for the uterine tissues to grow around it, and become consolidated in the new shape.

The element of time is of much importance in the treatment of chronic anteflexion. The cure is always tedious, and patience is required. Anteflexions are permanently improved by pregnancy for obvious reasons, but when the pregnancy is over the recumbent position should be maintained longer than usual.

The treatment of anteflexion in connection with pregnancy is a matter of great importance. When patients who have had anteflexion become pregnant, miscarriage is always to be feared. The absolute maintenance of the horizontal position during the first half of pregnancy is imperative in some cases. The round air-ball pessary is of great service at this juncture, a well-fitted cradle pessary will be found still more advantageous. These artificial supports are usually not required after the middle of pregnancy. The very close connection which subsists between anteflexion, and the liability to miscarriages, has not yet attracted professional attention, but according to the author's experience, this particular distortion of the uterus is by far the most common cause of early expulsion of the ovum.

RETROFLEXION OF THE UTERUS.—Posterior displacements are not of such frequent occurrence as anterior displacements of the uterus. Retroversion unaccompanied by flexion is exceedingly rare. In all cases of retroflexion there is of course version more or less marked.

There are many varieties:—

1. In regard to the *degree* of the flexion. Thus in the *first* degree, where the organ is slightly bent backwards; in the *second* where it is more decidedly flexed; and in the *third* where the fundus is so much inclined backwards that the organ resembles half of a circle, the two extremities being very close to each other. Naturally, the

[1] The plate published in the author's work, 3d edit. 1872, representing the instrument *in situ*, is not a representation of the mode of applying it which he has now, for some time past, adopted. In the plate in question the pessary is shown pressing on the uterus too low down.

more decided the flexion the lower the uterus as a whole. Thus in the third degree the fundus is generally very close to the anal aperture. 2. In regard to the *condition of the tissues* of the uterus, which may be very soft, or very hard, much swollen and congested, or comparatively normal in condition. In the early stage softness is usually present; in chronic cases the uterus may have become very hard. 3. In regard to the *shape* of the uterus. Thus in some cases the fundus, repeatedly thrust downwards, in the act of defecation, and invaginated into the rectum, assumes a conical shape from its being moulded and compressed by the sphincter recti. In many cases the lips of the os uteri become knotty and turgid, especially the posterior lip, and finally the os is surrounded by hypertrophied hard lips. 4. In regard to the *canal* of the uterus, which in many cases is much narrowed. 5. In regard to the *cavity*, which is frequently much enlarged and distended by retained menstrual or mucous secretions. 6. In regard to *sensitiveness*. When recent a slight flexion may induce very great tenderness. Usually the degree of tenderness is proportionate to the degree of the flexion. 7. In regard to *duration*. In an old-standing case sensitiveness may have been lost. In recent cases there is greater congestion. In recent cases, also, atrophy at the seat of the bend has not become very evident, whereas, in long-standing cases, the uterine wall may be very thin at the seat of the flexion. 8. Occasionally there is a slight *lateral* tendency of the retroflexed uterus. 9. In regard to *complications*. Perineal rupture is a serious complication; peritoneal adhesions binding the uterus down in its abnormal position are of great importance.

The *course* of retroflexion is chronic. The course is usually from bad to worse unless suitable treatment is adopted. Its effect on the patient is in many cases most disastrous. Incapacity for exertion, for the ordinary business of life, helpless invalidism, these are the effects witnessed in long-standing severe cases. The patient has often become an invalid before the nature of the disorder is known or even suspected. Its commencement is often insidious. "Spinal weakness," "hysteria," "dyspepsia," under these or other names the disorder establishes itself, and not uncommonly has existed for two or three or indeed many years before it is actually detected.

Symptoms.—There are no special symptoms of retroflexion, but this distortion can frequently be distinguished from anteflexion by analysis of the symptoms present. Pain or difficulty in locomotion (dyskinesia) is the commonest, and may be observed in all degrees of severity, beginning with cases of slight pain on walking some distance, and ending with cases where the slightest movement induces extreme suffering. Here it should be stated, also, that in a few cases the condition approaches to paraplegia, the power of walking being actually impaired. This *reflex paraplegia*, for such it seems to be, was mentioned as produced by this form of displacement some few years since by Dr. Priestley. I have observed the occurrence in a few cases. It is very important not to confound it with true spinal disease. And it must not be confounded with ordinary dyskinesia. In the latter case walking is possible, but produces pain; in the case of reflex partial paraplegia, the power of walking is lessened, and the action of certain muscles is imperfect.

The pain on motion observed in cases of retroflexion is evidently due to the temporary increase of the flexion produced by the motion. It can always be predicated that certain exertions or positions of the body will produce pain, and the result is in conformity with this idea. Pain on defecation, pain on sitting, on stooping, &c., all belong to this category.

Obstruction to micturition is not uncommon. Retention of urine may occur from time to time, but it is not a constant symptom.

Pain in the sacral region is common, pain in the hypogastric lateral regions is sometimes also noticed in a very acute degree. Pain extending down the course of the sciatic nerves on one side or the other is not uncommon.

Sickness or nausea is common. The severity of this symptom varies much. The patient is generally most sick when the flexion is greatest. It may threaten her with dissolution from its long continuance. It is not a constant symptom.

Liability to abortions.—Retroflexion frequently prevents conception, but, conception having occurred, abortion very frequently follows unless the case be understood and properly treated. Abortion is more certain to occur in retroflexion than in anteflexion cases, that is to say, when left to themselves.

Sterility is a common result.

Menstrual derangements.—Menstruation is often profuse; clots are often observed; in some cases a profuse flooding occasionally happens. Often the duration of the discharge is prolonged, sometimes even for two or three weeks. Dysmenorrhœa is not seldom met with, and may be very intense. In some cases the discharge is too scanty and of bad color. In a few cases amenorrhœa is produced, menstruation actually ceasing.

Leucorrhœa of a very troublesome character is often observed. That variety which may be described as "puri-

form leucorrhœa occurring in gushes," is rather common in chronic cases of retroflexion, the discharge consisting of retained puriform secretions from the interior of the uterus. In other cases it is the result of the congested condition of the cervix and of the glands there situated.

Difficulty in defecation, sometimes amounting to obstinate constipation, is common. Painful defecation is rather common, every straining effort increasing the flexion. In some cases a constant tenesmus or diarrhœa results.

Pain on intercourse (dyspareunia) is common. Hysterical phenomena of great intensity are occasionally observed. In a few cases convulsions occur. These reflex phenomena appear to depend on the compression of the tissues of the uterus at the seat of the flexion.

Diagnosis.—In cases where the flexion is in the first degree, and the uterus not much lowered in the pelvis, the diagnosis is difficult, unless the sound be used. But ordinarily there is no difficulty, the exploring finger readily defines the outline of the fundus in its abnormal position. A vaginal or rectal examination or both should be made. The condition principally liable to be mistaken for retroflexion is fibroid outgrowth low down at the back of the uterus. Other tumors—pelvic hæmatocele, pelvic cellulitis, uterine fibroids pendulous behind uterus, small ovarian tumors, prolapsed ovary, &c., do not resemble the fundus uteri in outline or consistence. The sound conclusively proves the nature of the malady, but is not available when pregnancy is possible.

Prognosis and Treatment.—The curability of a long-standing case of retroflexion is always a matter of doubt. When the organ has been seriously distorted for some years, and the thickness of the walls at the point of flexion materially reduced, particularly so. Whereas a case of a few months' standing only is usually readily curable. The well-known plasticity of the organ is a great help in the curative process.

General treatment is usually imperatively necessary, whether local treatment be employed or not. Tonics, and a careful restorative dietary necessary for general weakness and mal-nutrition, are usually required in these cases.

The positional treatment is to be conducted as follows: As a rule the patient should maintain the horizontal position, lying on the side, and frequently partly on the chest, in the prone position on an incline of pillows. Sitting is injurious. Very short walks may be permitted in not very severe cases. Stooping, lifting, or other such exertions are prohibited.

Mechanical internal treatment is necessary in cases where the malady is established, and it may be conducted in several ways.

Occasional replacement of the organ and unbending it by the sound, together with positional treatment, answers well in some cases. The sound should be very gently used, for mischief may otherwise be done.

But in most cases a pessary is required as an aid, and in very many is essential. The best pessary is the Hodge-shaped pessary, of size and form adapted to the case, by which the fundus is pushed upwards, and aided by positional treatment it is capable of effecting frequently almost all that is desired. It should be worn continuously. The sound may be used in conjunction with the wearing of a pessary. In a case where the uterus has become hardened the Hodge pessary alone and unaided by positional treatment and use of the sound will fail. Copper-wire rings $\frac{1}{12}$ inch, covered by india-rubber, so as to make the whole thickness $\frac{5}{12}$ of an inch, and made of various sizes, answer admirably, as they can be bent into any required shape. Other materials are often used. As regards vaginal pessaries, it is necessary to bear in mind that the fundus may be bent backwards over the top of the pessary unless the pessary be sufficiently long. The sound offers the only means of ascertaining if the flexion be really controlled by the pessary. If the flexed uterus be hard the pessary simply pushes up the fundus without unbending the uterus.

Intra-uterine stem pessaries are sometimes employed, but require great care. They are not so suitable for retroflexion as for anteflexion.

Dilatation of the uterus by tents is sometimes employed as preliminary to other treatment.

The treatment is often required to be spread over a long time in order to completely restore the uterus to health. The malady is one prone to recur. Pregnancy occurring in the course of the case is favorable, but the flexion will probably re-appear after the pregnancy is over and must be kept in check by suitable treatment.

The congestion attendant on retroflexion is treated by some with leeches or scarifications. But this congestion disappears when the uterus is straightened. The congestion is mechanical in its origin and quickly subsides on placing the patient in a favorable position, or on elevating the fundus posteriorly by means of a pessary.

The hypertrophy of the os uteri and of the uterine body often present in long-standing cases is very difficult to get rid of, but it usually gradually lessens as the shape of the uterus is improved.

Lateriflexion of the Uterus.—Lateral displacement and flexion of the uterus generally occur to only a very slight extent. It frequently happens that in anteflexion the fundus is distinctly inclined a little to one side; and the same holds good to retroflexion. But distinct lateral flexion is very rare. Tumors may of course displace the uterus in the lateral direction.

The slight lateral direction which the fundus sometimes takes whether in posterior or anterior flexion, is however a practical matter of great importance, for it is always more difficult to treat such cases successfully than those in which the flexion is directly backwards or forwards. Modifications in the shape of the pessary employed are requisite, and advantage must be taken of the influence of gravity by placing the patient in a proper position to obtain the benefit of it. Thus in a case of retroflexion tending to the right side the prone position inclining to the left would materially help in the management of the case.

Chronic Inversion of the Uterus.—Chronic inversion of the uterus is generally the result of labor, the organ becoming inverted at or after the removal of the placenta.

The inversion may be complete or partial. Its acute stage cannot be described in this place. In its chronic form it is liable to be met with months or years after a particular labor.

Varieties.—The organ is completely inverted, so that no portion of the uterine cavity remains as such, or it is a partial inversion.

Course, Symptoms, and Diagnosis.—The malady has no tendency to a spontaneous cure, the uterus becomes hardened and firm in its distorted shape, atrophy of the compressed portions of the uterine wall and hypertrophy of others result. In complete inversion there is less alteration of this kind. The symptoms consist of pain and "bearing-down" more or less continuous, but not present to a severe degree after a few months in all cases; almost continuous losses of blood, sometimes very profuse, alternating with puriform discharges; general discomfort and dyskinesia; menstrual periods not so distinct as usual from hemorrhages. These symptoms persisting in greater or less severity, and dating from a particular labor. The symptoms are very similar to those of uterine polypus.

The diagnosis can be established by examination only. A rounded tumor presents at the os uteri (partial inversion), or fills the vagina, and appears to grow from the upper extremity of the vagina (complete inversion). In complete inversion the sound cannot possibly be passed beyond the pedicle. In partial inversion the sound enters half an inch, or an inch perhaps, beyond the constricting ring. This latter circumstance distinguishes it from polypus; for in cases of polypus the sound passes the full distance into the uterus. To this statement there is one exception, viz., in the case of a polypus which is complicated with partial inversion. Double examination per rectum and suprapubic, or by a sound placed in the bladder, shows that the body of the uterus is wanting from its proper position, and a depression can usually be felt superiorly, marking the spot of inversion. In doubtful cases this double examination is of great value.

Treatment.—Formerly the only treatment followed was removal of the tumor by excision, or the whip-cord ligature. Of late years many cases have been successfully and completely cured by skilfully-applied continuous pressure, whereby the inversion has been removed. Difficulties in the way of this treatment are greater in some cases than others. The inverted uterus has been restored after fifteen years' duration of the malady, and in very many cases after shorter intervals. The functions of the organ have generally also been fully restored by the reduction. The pressure does not succeed in some cases. To aid in the process it has been recommended to incise the uterus bi-laterally at the situation of the os (Marion Sims and Barnes). When reduction cannot be effected, the whip-cord ligature may be applied. Dr. M'Clintock's plan is to place a strong ligature round the pedicle for three days, and then to excise the tumor.

Hypertrophic Elongation of the Uterus.—(*See* Prolapsus.)

Prolapsus of the Uterus.—Prolapsus of the uterus is a general term, implying descent of the organ within the pelvis, or a further descent—actual protrusion externally. By some writers the term "procidentia" is applied to the latter class of cases.

There are various forms of the affection. It is rarely simple, for there are very few cases in which the uterus, unchanged in form or size, descends to any considerable extent; the majority of cases are complicated.

Slight Internal Descent of the Uterus.—Prolapsus in this form is an almost invariable accompaniment of flexion of the uterus, whether forwards or backwards. The organ as a whole is

too low in the pelvis. Another associated condition is enlargement of the uterus, *e. g.*, retarded involution after parturition, or simple hypertrophy, the result of long-standing chronic congestion. Another possible associated condition is rupture of the perineum, produced by some former labor. It is rare to meet with the uterus low down in the pelvis, except in association with one of the conditions here mentioned.

Considerable Descent of the Uterus.—Here the organ is so low that it is on the point of projecting at the vulva. This is a condition very rarely met with, except in association with decided flexion, chronic enlargement of the uterus, or considerable deficiency of the perineum.

Cystocele.—In cases of cystocele the floor of the bladder is protruded at the vulva in form of a round soft tumor. In these cases the uterus is always, according to the writer's experience, in a state of very decided anteversion or flexion, and in most of the cases there has been rupture of the perineum. But acute anteflexion may produce it when the perineum is sound. The uterus is quite low down, and close behind the bladder.

Rectocele.—Here the tumor at the vulva is a portion of the rectum. It is usually produced by the combination of retroflexion of the uterus and rupture of the perineum. The uterus is very low down in its retroflexed state, and close to the perineum.

Complete Prolapsus (Procidentia).—Here the uterus is outside the vulva. It is usually the case that the uterus is protruded in the retroflexed state. To the majority of such cases the following description applies: The enlarged retroflexed uterus, which has for some time occupied a very low position in the pelvis, finally escapes altogether from it, especially if the natural barrier to such escape—the perineum—be deficient. One proof of this is that, in reducing the prolapsus, the uterus is found acutely retroflexed. Anteflexion of the uterus is not found in complete prolapsus.

The uterus is often of great size in these "complete" cases. The mucous membrane covering it is often much ulcerated, and abraded from external friction.

Prolapsus with Hypertrophic Cervical Elongation.—This condition, first well described by Huguier, presents two or three varieties. The *vaginal portion* of the cervix uteri, alone, may be much too long and protrude externally. It may occur in single or married women, or the *supra-vaginal* portion of the cervix may be so elongated and hypertrophied, as well as prolapsed, that a large truncated tumor extends out of the vulva, and the whole length of the uterine cavity from external os to top of fundus may be five to seven inches. The greater part of the canal so elongated is the cervix. Properly speaking, these are cases of descent, not necessarily of the uterus proper, but of elongation and descent of the cervix. Laundresses and cooks are particularly subjects of this variety of prolapsus.

Etiology.—Prolapsus of the uterus is the result of the operation of causes generally complex. The following are directly or indirectly causes:—

1. *Pressure downwards.*—This may be made so excessive as to cause prolapsus in many ways. *a.* Extra weight of the uterus, *b.* extra weight of parts above (*e. g.*, intestines, omental fat, ascites), *c.* unusual straining force applied above as in straining efforts in defecation or micturition, straining induced by flexion of the uterus (often very great), *d.* excessive strains on abdomen in lifting weights, *e.* violent propulsion of uterus downwards in cases of accident—*e. g.*, falling on the nates.

2. *Defective resistance.*—Under this head come *a.* loosening or relaxation of uterine ligaments, *b.* destruction partial or complete of vaginal floor, viz., perineal rupture, *c.* absorption of fat near vulvar aperture, *d.* general debility impairing muscular resistance at vulvar aperture.

3. *Operation of a dragging-down force.*—1. Presence of a prolapsus. 2. Hypertrophic elongation of the cervix. 3. Tumors growing at the os uteri.

Treatment.—The treatment of slight internal prolapsus consists generally in treatment of the anterior or posterior version or flexion which is so generally present. This treatment is however rendered difficult in many cases from the presence of perineal rupture, so that a vaginal pessary is not so readily or satisfactorily applied. Hence larger pessaries are requisite when the perineum is defective. In cases of extensive rupture of the perineum a plastic operation to restore the lost support is necessary.

In the cases of complete prolapsus it is essential to the success of the treatment that the shape of the uterus be attentively considered. For instance, if there be a chronic severe flexion of the uterus it will be of little service to restore the perineum by operation unless the flexion be at the same time or subsequently treated; otherwise the protrusion will be certain to recur.

When perineal operations are required, as they frequently are, the operation must

be carefully adapted to the end in view. It is frequently necessary at the same time to reduce the size of the vagina by taking up a portion of the floor.[1] Thus the size of the vulvar aperture and of the vagina are at one and the same time reduced.

Many cases of severe prolapsus are susceptible of relief by application of carefully adjusted pessaries or external supports of various kinds. For severe cases of prolapsus not admitting for various reasons of absolute curative treatment Zwank's pessary is very serviceable.

DISORDERS OF UTERINE FUNCTIONS.

By Graily Hewitt, M.D., F.R.C.P.

Amenorrhœa.

Menstruation is entirely absent when the ovaries are wanting or when the uterus is imperfectly developed, or when, the os uteri or the vagina being closed, there is no outlet for the menstrual fluid. In such cases the amenorrhœa is complete. But the menstrual discharge having been established may become much diminished, or very scanty and irregular, or it may prematurely cease; and this cessation may occur at any period. The term amenorrhœa is also applied to the latter class of cases.

Diagnosis of the Cause of Amenorrhœa in cases where no Menstruation has ever occurred.—Ordinarily puberty arrives and menstruation occurs before the age of sixteen or seventeen. But in some instances it is delayed, and the primary appearance occurs a few years later. These are cases of delayed puberty, and at first it is not possible without internal examination to pronounce an opinion upon them. Another class of cases are those in which the menstrual secretion is pent up and cannot escape. These cases are characterized by presence of pains in the uterine region, generally occurring particularly at monthly intervals, and the pains may be very intense. The diagnosis of the latter class of cases could not be arrived at without an internal examination. The degree of development of the uterus is ascertained best by a double examination—one finger placed in the rectum, and the catheter in the bladder. Retention of catamenia usually involves the presence of a swelling in the hypogastric region, due to the distension of the uterus. There may be also a distension of the vagina when the hymen is imperforate. It must not be forgotten that pregnancy is possible even in cases where no menstruation has yet occurred

Imperfectly Established Menstruation.—This category includes very many cases. The discharge is imperfect; it occurs perhaps once or twice in very small quantity, and not again; or there is an occasional scanty discharge at long intervals. In this class of cases the phenomenon termed *vicarious menstruation* is liable to occur, by which is meant that at the usual monthly period a sanguineous fluid escapes, usually from the stomach or from the lungs, or from some other internal mucous surface, or it may be from the surface of an external ulcer.

In cases of imperfectly-established menstruation the cause is *general* or *local*, or both combined. In many cases the amenorrhœa is the result of general feebleness, insufficient food, &c. Growth is rapid, and much nourishment is required. *Chlorosis*, as it is termed, is sometimes observed under these circumstances, the amenorrhœa being coupled with a very peculiar greenish-yellow appearance of the skin. There is present in these chlorotic cases a profound anæmia, great feebleness, tendency to headache, coldness of extremities, &c. But amenorrhœa may occur in young women also, as the result of over-exertion, walking, riding, &c., in which cases it appears to be due to disturbance of the position and shape of the uterus. The soft, imperfectly-nourished uterus (see p. 751) readily gives way under excessive physical pressure. Thus, when the system is not well sustained, and there is too much exertion, one possible result is amenorrhœa.

Suppression.—One form of amenorrhœa is that arising suddenly from taking cold, standing on a wet floor, taking a cold bath during the menstrual flow, &c. Mental emotion is also a cause of suppression. Amenorrhœa arising in this way is not seldom serious in its effects, or difficult to

[1] Author's work on Diseases of Women, 3d edit. p. 293.

cure. It seems probable that some internal change of an important kind must occur in these cases, the part affected being the uterus, or the ovaries, or both; or what seems not unlikely consisting in an inflammatory effusion of lymph over the peritoneum, covering the ovaries, and perhaps extending into the Fallopian tubes. Suppression may occur also from fevers; in a more gradual way it may occur from extreme weakness, however induced, from phthisis, &c.

Chronic flexion of the uterus is occasionally observed to produce complete cessation of menstruation, and lead to its premature termination, this result arising from the compression and hardening of the organ, and the great obstruction of the uterine canal.

Lastly, it must be stated that amenorrhœa may occur from change of air, or place, or habits of life, without further ascertainable cause; that it may result from fibrous tumor, or chronic hypertrophy of the uterus; from cystic, or other diseases of the ovary.

Treatment.—Amenorrhœa arising from absence or original defect of the generative organs is rarely susceptible of cure. In cases of infantile uterus Simpson's treatment by the use of galvanic intra-uterine stems has in some cases succeeded.

Amenorrhœa and retention, due to imperforate condition of the hymen or vagina, or cervix uteri, are cured by operation. In these cases the aperture should at first be made very small, so as to allow of a very gradual escape. It may afterwards be enlarged.

In amenorrhœa from suppression hot hip-baths should be used, and the patient kept in bed at the proper period. Mustard may be applied to the thighs, warmth to the hypogastrium. Leeches applied near the groins are sometimes indicated. Special emmenagogues may also be employed. Any discovered internal disorder should of course be appropriately treated.

In cases of amenorrhœa due to flexion of the uterus the distortion must be suitably treated. Softness of the uterus is likely to be associated with amenorrhœa, and slight flexion, particularly during the first two or three years of menstrual life. It will be found in such cases that complete rest in the horizontal position is extremely efficacious in inducing return of menstruation. The dorsal horizontal position is usually the best. Great care in regard to diet is required, for serious defect in nutrition is the most important element in such cases. As a rule cases of amenorrhœa in young women are best treated by rest, good feeding, and fresh air. Experience shows that long walks or violent exercise of any kind are detrimental.

The best emmenagogues are tonics, such as iron, quinine, good food, and careful general hygiene. Iron in various forms, but in small doses, is usually well borne. Careful attention to the bowels is always required, and occasional mild aperients may be necessary. In cases where the liver has become disordered, a mild mercurial may be given with advantage at long intervals. Special emmenagogues should only be given when other more simple remedial measures have failed. Aloes, myrrh, essential oil of savin, ergot, are the emmenagogues most generally in repute. Mustard cataplasms on the thighs, hot hip-baths, with or without mustard, injections of aloes *per rectum*, injections of hot water *per vaginam*, are valuable adjuvants. [The continued galvanic current has been found successful in some cases.—H.]

Dysmenorrhœa.

Dysmenorrhœa implies presence of pain or discomfort in the pelvic region, at or about the time of the menstrual discharge. The menstrual discharge is also almost invariably abnormal in some other particular, *e. g.*, it is scanty, or almost entirely absent, or it is delayed beyond the proper time, or it is profuse, or it is interrupted. The pain varies in intensity, sometimes amounting to slight discomfort only: in cases of an extreme character, being so severe that the patient is beside herself with the indescribable agony experienced. And between these two extremes all imaginable gradations are observed.

The seat of the pain is not constant. The sacral region is generally the part spoken of, but in severe cases the uterine region is referred to. The pain is as a rule intermittent in character.

The cause of the pain has been the subject of much dispute, but of late years the balance of opinion has been strongly in favor of the view that dysmenorrhœa is the result of an obstacle to the escape of the menstrual fluid. The pain is due to the attempts made by the uterus to expel its contents, the uterus contracting, and being thereby thrown into a state of spasm ("uterine colic" of the older writers). The pain is relieved when the uterus succeeds in expelling the whole or a part of its contents. The obstruction to the escape of the fluid is produced by different causes, but the most common cause is flexion of the uterus, producing compression and constriction of the uterine canal at or near the internal os uteri.

The uterine canal at the internal os is naturally small; the canal is surrounded by dense unyielding tissues; bending of the uterus implies narrowing of the canal at this situation, which narrowing be-

comes so considerable in many instances, as to amount to virtual closure; and the menstrual fluid and *débris* find no sufficient outlet. Further circumstances often lead to temporary exaggerations of the flexion at the menstrual period, acute congestion of the body of the uterus may set in, and the whole organ becomes swollen. Hence the menstrual evacuation is more and more hindered. Again, a quantity of menstrual fluid having collected *in utero*, the body of the uterus becomes unnaturally distended, and hypertrophy with dilatation follow. Clots not seldom form in the uterus as a result of the delayed evacuation, and their exit is attended with terrible suffering. Dysmenorrhœa may lead eventually to complete suppression of menstruation, but in some cases it leads to the precisely opposite effect, viz., very profuse losses (menorrhagia), the result of dilatation and hypertrophy of the uterus.

Flexion is the common cause of obstructive narrowing of the internal os. But there may be congenital narrowing at this situation, and small fibroid tumors sometimes grow in this locality and induce severe dysmenorrhœa.

The external os uteri may be the seat of obstruction. Congenital narrowness of the external os occurs in a few cases, with dysmenorrhœa as a result.

It appears that in some few cases the pain during menstruation depends on some morbid condition of the ovaries. Chronic inflammation of the pelvic peritoneum may produce exudation over, and thickening of the covering of the ovary—ovulation is thus impeded and pain would result. Probably in some cases also pain during menstruation arises from actual passage of blood from the uterus into the peritoneal cavity, giving rise to pelvic hæmatocele of the intra-peritoneal variety.

It follows from what has been stated, that the large majority of cases of dysmenorrhœa are really cases of *menstrual retention*. The clinical evidence in favor of this conclusion is overwhelming, for the pain always undergoes mitigation or complete arrest when procedures are taken, or measures adopted calculated to provide a more easy passage for the menstrual fluid from the uterus.

Concurrently with dysmenorrhœa, serious *vomiting* is not rarely observed. Nausea is a common symptom.

Sterility is commonly conjoined with dysmenorrhœa, impregnation does not occur, because the patency of the uterine canal is interfered with by the flexion usually present. In some cases the sterility has probably its explanation in the fact that the uterus more or less constantly contains retained morbid products.

Membranous Dysmenorrhœa is a term applied in cases where a distinct membranous cast of the uterine cavity is expelled. It may be in one piece or in several pieces. In these cases the mucous lining of the uterus appears to have a thicker structure than usual, and when thrown off, does not, as under ordinary circumstances, break down into impalpable shreds. The expulsion of this thickened lining gives rise to severe pain.

Treatment.—In slight cases general measures may suffice. Of these the most important is rest in the horizontal position; on the back if it be a case of anteflexion, on the side or on the face if the uterus be inclined backwards. If the state of the uterus be not known, the horizontal position on the side may be safely recommended. Care should be taken to keep the bowels unloaded. Opiate injections per rectum or morphia suppositories are very useful in relieving the pain. Ether, lavender, henbane, cannabis indica, are remedies which may be used. Warm fomentations, vaginal injections of rather hot water (100° Fah.), or the hot hip-bath are useful adjuncts. These latter procedures are also serviceable in the more severe cases. A popular remedy is gin and water, the efficacy of which, it may be conjectured, depends on its increasing the quantity of urine, thereby distending the bladder and helping to straighten the uterus; such an explanation at least would hold good in cases of anteflexion of the uterus. Guaiacum, black hellebore, colchicum, camphor, are other remedies strongly advocated by various practitioners of repute.

If the case be one of marked character, and the uterus is certainly flexed, the case must be dealt with appropriately. In quite young women, 16–18, general treatment may suffice, the uterus is probably very soft and the nutrition low. The case may, in some cases, be treated without special reference to the dysmenorrhœa, rest, good feeding, and a general restorative system of treatment being enforced, while the dysmenorrhœa, treated only by palliative measures, in time ceases. The very best effects result from such treatment, but only in these cases.

On the other hand where the patient is older, or where the uterus has become hardened in its distorted shape, general measures are useless from a curative point of view. The uterine canal must be mechanically straightened, and thus dilated in order to relieve the dysmenorrhœa. In some few cases bi-lateral incision of the internal os is practised, but this procedure is only useful when followed by the use of a stem pessary. As a rule the combination of occasional dilatation by a metallic dilator, with use of a suitable vaginal pessary, affords satisfactory results.

Cases of congenital or acquired narrowing of the external os uteri requires operative enlargement of the aperture by the knife or by scissors.

Menorrhagia.

The term menorrhagia implies excessive loss at the menstrual periods. The average quantity may be only slightly exceeded, or it may amount to a profuse flooding. The loss may be profuse and be limited to the ordinary number of days, or the period may be both profuse and very protracted, extending to a week, or even a fortnight. In many cases clots are expelled together with blood. As a rule the discharge is somewhat intermittent, there being alternate gushes of discharge, followed by periods during which the discharge is little.

The effect of the repeated losses in severe cases is to produce a profound anæmia, general feebleness, impairment of function of various organs. The watery condition of the blood, usually present in long standing cases, is a cause of persistence of the menorrhagia.

Etiology.—Menorrhagia is sometimes due to *general* causes. Chronic visceral disease, *e. g.*, of the liver, of the heart, of the kidneys (especially Bright's disease) may produce it. Any general prostrating influence, *e. g.*, over-lactation, mental worry, fever, sexual excesses may give rise to it. Lead-poisoning, malaria, residence in tropical climates, are other general causes. Severe shock, mental or otherwise, may give rise to menorrhagia. But ordinarily menorrhagia is found to be dependent on local causes. The most common cause of menorrhagia is flexion of the uterus. In severe cases it is not uncommon to find the uterus much hypertrophied, its cavity enlarged, and its shape decidedly distorted. Menorrhagia is not seldom one of the most severe effects of anteflexion or retroflexion. The characteristic of such cases, is that the loss occurs in considerable intermittent gushes, often accompanied by clots. The uterus becomes distended with blood, the escape of which is prevented by the flexion. The organ then increases in size, and at the end of a certain time, having by its mere distension become somewhat straightened, the retained fluid escapes in a gush. The process repeats itself. In the end the uterine cavity becomes greatly enlarged, and in time the enlargement becomes permanent, the walls become thickened, and hypertrophy ensues in consequence of the greater muscular activity of the uterus (Dr. John Williams). The loss of the blood at each menstrual period may amount to a flooding. The loss of blood is perhaps liable to be greatest in cases of severe retroflexion, but in many cases of anteflexion it is very great.

Cases of severe menorrhagia are not seldom observed when repeated abortions have occurred in consequence of a chronic ante- or retro-flexion; the circumstances then present favor the production of a chronic hypertrophy and distension of the uterine cavity, and menorrhagia of a very intractable character ensues. Defective involutions of the uterus, whether after abortion or after labor at full term, is an important causal element.

Chronic inversion of the uterus is another local cause of menorrhagia. Cancer of the uterus is frequently also attended with menorrhagia, but in these cases there is more generally also hemorrhage at other than the menstrual periods also. Polypi and fibroid tumors of the uterus also may give rise to severe losses at the menstrual periods, but in such cases also hemorrhage is liable to occur between these periods. The same remark applies to other diseases of the uterus.

It must be remarked that menorrhagia is sometimes associated with effusion of blood (hæmatocele) in the neighborhood of the uterus. In some of these cases the blood appears actually to pass from the uterine cavity into the peritoneum. Distension of the uterine cavity, due to obstruction at the internal os (from flexion) may probably be set down as an occasional cause of this latter occurrence.

A fungous condition of the mucous membrane of the uterus is held by some authorities of repute to be a not uncommon cause of menorrhagia.

Treatment.—In cases where the profuse loss is dependent on general disease and not on local disorder of the uterus, attention must be directed to removal of the cause, and means taken to prevent, as far as possible, undue loss of blood. A general, tonic invigorating system, including careful feeding and avoidance of exertion, is required in cases of great debility. Iron is very necessary. Tonics and purgatives are frequently both required in cases of sluggish circulation and slow hepatic action. Change of air, hip-baths of tepid water, sponging the surface and moderate exercise are generally indicated. Above all rest in the horizontal position during the catamenial periods is desirable. Excitement of all kinds should be avoided.

During the period of the flow certain measures may be adopted to diminish the quantity of the discharge. Sulphate of magnesia, combined with dilute sulphuric acid, is a favorite remedy. Rather strong doses of tincture of perchloride of iron are often serviceable. Ipecacuanha, gallic acid, cannabis indica, and opium are

other remedies recommended. A vaginal douche of hot water will sometimes prove useful. Ergot is proper in cases of relaxed atonic uterus; ice applied to the spinal column is a remedy also to be recommended in such cases. When the loss is so great as to amount to a flooding a vaginal plug may be used. Two or three yards of wetted bandage forms an efficient plug, to be inserted through a speculum. Iced water may be applied over the pubes in such cases. Ether, ammonia, and brandy may be given internally.

In cases where the menorrhagia depends on local uterine disease appropriate treatment must be employed. In cases of flexion of the uterus the remedy is to cure the flexion by straightening and opening up the uterine canal, whereupon the fluid readily escapes. Experience shows that the menorrhagia, though just at first a little increased by placing the uterus in its proper position and opening the canal, is speedily relieved. But in cases where the uterine cavity has become permanently distended, and its walls hypertrophied, the menorrhagia is not always cured so quickly. Other local disorders causing menorrhagia, *e. g.*, polypus, cancer, require special treatment. In certain obstinate cases of menorrhagia intra-uterine medication is sometimes practised. Styptics, as perchloride of iron, tincture of iodine, or actual caustics, as nitrate of silver or nitric acid (Atthill) have been employed. Preparatory to such procedure the cervix uteri is dilated, a precaution necessary to avoid possible passage of a caustic fluid into the Fallopian tubes (Savage and Routh).

LEUCORRHŒA.

The term leucorrhœa implies presence of a non-sanguineous discharge from the female generative passages.

Varieties. A.—In regard to SOURCE. In some cases the discharge proceeds from the *vulva* and parts surrounding the vaginal entrance. In others it proceeds from the lining of the *vaginal canal.* In others again its source is the os uteri and the lining of the cervix (*cervical*), and lastly it may proceed from the uterine cavity itself (*intra-uterine*).

B.—In regard to PHYSICAL CHARACTERS. Thus in some cases the discharge is a *watery*, or nearly or quite transparent fluid. In other cases it has a *puriform* character, presenting more or less thick creamy consistence. Another important variety is the *offensive* discharge, which may be puriform or more or less watery or slightly tinged with red. Lastly must be mentioned the *intermittent* variety coming away from time to time in gushes, generally of a puriform character, sometimes offensive, sometimes more purely watery in consistence, and proceeding usually from the interior of the uterus. As a general rule the discharge in cases of leucorrhœa is a mixture of secretions from various parts of the generative passages. It may contain mucus in a tenacious condition and in compact masses formed in the cervical canal; epithelial *débris* also in greater or less quantity from the cervix or from the vagina.

ETIOLOGY.—Leucorrhœa is constituted as a rule by an increase in the normal secretion of the affected parts. The various portions of the internal generative tract produce secretions which differ in quality. Hence the variety in the physical characters of the fluid. The general causes may be first considered. General weakness or debility may produce leucorrhœa, the secretions being increased in quantity owing to the congested condition of the mucous membrane of the uterus or vagina or vulva. This general weakness may be associated with disease of large and important viscera, *e. g.*, the heart, lungs, liver, &c. It may be due to overlactation, to semi-starvation, to that lowering of the general nutrition of the body which constitutes the first stage of phthisis. It may be present at a later stage of this latter affection. Residence in marshy or damp localities has often been noticed as favoring the occurrence of leucorrhœa.

The *local* causes are very numerous. In the first place must be mentioned *gonorrhœa*, in which case the discharge proceeds, at first at all events generally from the urethra and vulva, and is of a greenish yellow color. Later on it may produce inflammation of the vagina or cervix uteri, or parts beyond, and give rise to a discharge having a somewhat different physical appearance. *Syphilis* may occasion leucorrhœa, vulvar or vaginal, and probably also it may give rise to intra-uterine irritation and leucorrhœa. Ulcerated surfaces are usually observed at the vulva or in the neighborhood under such circumstances.

Flexions of the Uterus constitute a very common cause of leucorrhœa. Under these circumstances the leucorrhœa is cervical or intra-uterine, sometimes both. The cervix of the uterus, congested and turgid with blood, pours out from its interior a mucous alkaline secretion, often in great quantity, which, mixing below with the vaginal acid secretion, assumes a creamy appearance. This congestion of the cervix may be due to other causes than flexion, but the latter is its most common antecedent. Further, when the cervix has become thickened and hypertrophied, the lining membrane is permanently in a state of engorgement, and increased secretion is the result.

There is a peculiar and very important variety of leucorrhœa, designated above as *intermittent*, which is usually connected with presence of flexion of the uterus, and deserve here a special mention. The secretions of the body of the uterus being prevented escaping readily owing to the flexion, a difficulty which is greater or less according to circumstances, accumulate *in utero*. Being retained they irritate the uterus, more fluid is secreted, and the cavity is more dilated. After a time, or in consequence of the position of the uterus becoming altered for the moment, the discharge escapes in a gush. This process repeats itself perhaps two or three times a day, perhaps only once in two or three days. It is more apt to occur during the week or two after menstruation. This intermittent leucorrhœa is an almost certain sign of the existence of an uterine flexion. Not unfrequently a pain is felt indicating uterine contraction concurrently with the escape of the fluid. Patients sometimes describe the occurrence as the breaking of an internal abscess. Further, it is the fact in some instances, that the discharge in these cases is very offensive, owing to decomposition of the fluid in the uterus. Such intra-uterine accumulations may probably occur when no flexion of the uterus is present, owing to agglutination of the os uteri, or of some part of the cervical canal. A continuous puriform leucorrhœa is frequently also produced by flexions directly or indirectly, congestion, turgescence, and hyper-secretion of the cervical and other glands being thereby produced. The majority of cases of obstinate leucorrhœa belong to this category.

Defective involution of the uterus is a not uncommon cause of leucorrhœa; which may be cervical or intra-uterine in origin. *Polypi of the uterus*, fibrous and mucous, may occasion leucorrhœa. Polypi give rise generally to a rather watery leucorrhœa, but there are many exceptions to this rule. *Ascarides in the rectum* may occasion leucorrhœa particularly in children, in which latter case there is vulvitis usually present. In children also leucorrhœa is liable to occur from simple debility, and its presence has occasionally given rise to unfounded suspicions of the disorder being a communicated gonorrhœa. *Hæmorrhoids, presence of fecal accumulations, &c., vascular tumors of the meatus urinarius*, must be also included in the list of possible causes. *Cancer of the uterus*, epitheliomatous disease of the cervix, cancer of the vagina, &c., give rise to leucorrhœa, frequently offensive in character, sometimes (cauliflower excrescence of the os) of a brownish watery character, frequently more or less red in color.

Chronic inversion of the uterus occasions copious leucorrhœal discharges. *Congestion* of the uterus, as a whole, from whatever cause, *hypertrophy of the cervix, prolapsus of the uterus* in its various forms, are other causes of troublesome leucorrhœa. Excess in sexual intercourse and self-abuse are other possible causes of leucorrhœa.

Treatment.—The primary object in cases of leucorrhœa should be to remove the cause. This ought always to be sought for, and if possible removed.

General treatment is applicable in many cases, and if there be no special local irritating condition in existence, such general treatment alone may prove successful. Careful hygienic treatment, fresh air, moderate but regular exercise, sufficient nourishment, baths, frictions of the skin, change of air, regulation of the digestive functions and of the action of the bowels, are of great service. Habits of an injurious tendency must be corrected.

Local Treatment.—Injections are of great utility in all cases. The water employed is best used a little warm; a pint may be injected twice a day. Medicated injections containing alum, zinc, tannin, infusion of tea, nitrate of silver, are frequently employed. Medicated pessaries are also advantageously used in some cases. Most of the agents used are astringent in character; their action is usually limited to the vagina and os uteri; antiseptic injections are frequently employed when the discharge is offensive; tincture of iodine (one in ten of water), diluted carbolic acid, Condy's fluid, &c., are used under such circumstances. The hip-bath is an useful adjunct. Counter-irritation, in the shape of blisters or croton oil liniment to the sacral region, is sometimes of service.

If the leucorrhœa be found to be dependent on some local irritating condition, the foregoing treatment will probably prove only palliative. An appropriate and more radical treatment will then be required.

Secondary Effects of Uterine Disease.

Interference with Locomotion (Uterine Dyskinesia).—Impairment of power of locomotion is a symptom and effect of uterine disease so common and so important that it deserves to be considered separately and distinctly.

By uterine dyskinesia is meant an inability to walk or move, or perform certain of the ordinary motions of the body, without producing pain referable to the uterus, this pain being either situated in the sacral region or in the groin, and sometimes extending to the umbilicus. This inability varies exceedingly in degree, the pain or inconvenience produced by movement is sometimes slight, while in many instances it is very great, and in extreme cases it is so great that after a

time the attempt to move is given up, and the patient becomes completely helpless.

Writing on the subject some years ago, the author described this condition under the name of "uterine lameness," but the appellation "uterine dyskinesia" is more comprehensive, and perhaps more accurate.

This inability to perform certain motions without feeling pain referable to the uterus is not a paralysis in any sense of the word, at least in ordinary cases; but it does appear that in some few cases, of which Dr. Priestley has related instances, and which the author also has witnessed, a paralysis may occur to a more or less complete extent. Generally, however, the patient is perfectly able to move or walk, but the exertion always gives rise to pain.

This symptom or effect of the presence of uterine disease is so common that it has been undeservedly passed over; and it has certainly in many cases been misinterpreted, patients complaining of it having been often thought fanciful when they were really describing very positive and tangible phenomena occurring in their daily and personal experience.

Uterine dyskinesia is observed in almost all cases of flexion or distortion of the uterus; and it appears that this condition of the uterus is its most common cause. The act of walking or stooping, or going up and down stairs, or any movement of the abdominal muscles, gives rise to a temporary exaggeration of the existing flexion in these cases, and thereby occasions pain in the back or groins, or down the back of the thighs, or in the region of the ovaries. Chaissaignac, writing on the subject of the cause of pain on motion, observed in cases of uterine "deviation," thought it due to the concussion or shakings of the uterus thereby produced. But the above explanation appears more completely to cover the phenomena observed in these cases. It is a matter of interest to observe that in those cases where the uterine dyskinesia is greatest, there is universally found to be the greatest amount of tenderness of the uterus — a tenderness recognizable on making a digital examination. In acute flexions the tenderness is often extreme, and it is precisely these cases in which uterine dyskinesia is a most prominent and noticeable symptom.[1]

Pain in the various situations about the pelvis, in the back, in the groins, in the region of the ovaries, has been long associated with uterine disease. By many those pains felt in the ovarian region have been considered, but erroneously, as the author believes, as generally indicative of ovarian inflammation or irritation. It is a remarkable fact, however, that pains in these situations are very rarely experienced when the body is in a state of repose. (The pains felt at the menstrual period are here excluded from consideration.) It is chiefly when the patient moves, or attempts an exertion, that the pain occurs, and it is on inquiry found to be the case that the particular exertion which brings on the pain is the one which would be likely to exaggerate and intensify an existing distortion of the uterus.

It is hardly necessary to observe that all pains in or about the pelvis produced by motion are not due to uterine disease. Undoubtedly when the ovary is displaced, when it is tender or inflamed, pain may be produced; pelvic peritonitis also is a condition which would give rise to pain on movement. Doubtless, also, there are other like causes. But the statement that in the vast majority of cases these pains are connected with the particular disturbance of the uterus above described, will be found amply supported by clinical observation.

Further analysis renders it evident that there are two possible reasons for the circumstance that uterine flexions give rise to uterine dyskinesia. The existing flexion is always accompanied by more or less congestion, distension of the uterine tissues, and compression of certain other portions. On the whole, evidence is in favor of the conclusion that it is the increased compression of the uterine tissue at the seat of the flexion which is the principal cause of the actual pain. When the uterus is acutely flexed and intensely congested, the nerves are everywhere more or less affected; but at the seat of the flexion there is greater compression than elsewhere. Experience shows that the pain on motion does not occur, or is very perceptibly diminished, when this compression is removed; when, for instance, the uterus is made straight, and the condition causing such compression ceases to operate in this way.

Uterine dyskinesia is one of the earliest symptoms of uterine flexion, and as such it is a symptom which has an extreme importance.

Reflex Nervous Disturbances due to Uterine Disease.—There are two symptoms observed in certain cases of uterine disease which may be classed under the above head — *hysteria*, and *nausea* or *vomiting*. They both appear to be in reality nervous disturbances of a

[1] In those cases, also, where excessive internal tenderness is present, intercourse is necessarily attended with more or less pain. "Dyspareunia," the term suggested by Dr. Barnes to describe this symptom, appears to be more frequently, according to the author's experience, connected with the presence of flexion of the uterus than with any other abnormal condition of the sexual organs.

reflex character, the inciting agent being some abnormal condition of the uterus.

Hysteria.—The idea of the association of hysteria with disorder of the generative organs is of ancient origin, as the name itself implies. And although writers may be found who would contend that the generative organs are not concerned in the production of hysteria, this opinion is not one shared by those possessing most acquaintance with the subject of uterine and ovarian disease.[1]

Without professing to deal with exceptional and rare instances, those, for instance, of hysteria in the male sex, it will at once of course be conceded that hysteria is a disease *par excellence* of the female sex. Clinical observation shows that in the very large majority of cases hysteria, or hysterical manifestations, are observed in connection with some abnormal condition, or some irritation proceeding from the sexual organs. Assuming, therefore, that this view of the case is correct,—space renders it impossible to discuss this particular question at the necessary length—we may inquire what this abnormal condition or irritation actually is?

The author has formed an opinion on this subject which may be formulated as follows:—

In cases where the hysteria is more or less chronic, and more or less constantly present, where the patient is liable to paroxysmal attacks, hysterical in character, the exciting cause—the irritation, in fact—will be found to be a well-marked flexion of the uterus.

This opinion is based on clinical observation extending over upwards of seven years; during which time a tolerably large number of cases, such as those above alluded to, have been subjects of observation. The cases have one and all resolved themselves, on proper inquiry and investigation, in the direction above indicated; and the testimony of these cases has been so uniform and strikingly similar, that the author can have no doubt that the generalization in question is a sound one.

More than this, it has been observed in these cases that the tendency to hysterical attacks or manifestations has uniformly disappeared on measures being taken to relieve the disorder present, viz., to cure the existing uterine flexion.

The cases comprehended in the above description were of what may be termed typical character, and characterized by a tendency to repeated attacks or paroxysms. Concerning other cases in which hyperæsthesia, anæsthesia, and various slighter symptoms of hysteria are observed, the author has nothing to give as the result of actual personal observation, not having encountered such cases under circumstances where an internal exploration was possible; and he has had no means of testing the truth of the generalization above given in regard to its application to the slighter symptoms of so-called hysteria. Meanwhile the above statements are given for what they are worth; what that worth may be can be tested without any great difficulty by the observations of others.[1]

The hysterical paroxysm, according to the author's view, is the result of a reflex irritation. That irritation consists in the mechanical compression of certain portions of the uterine tissues. Such compression is produced in cases of uterine flexion by the alteration of shape which the uterus undergoes.

It may be inquired, Why is it that the compression of uterine tissues produced by flexion does not invariably produce hysterical manifestations? It is to be replied that reflex movements are not in all cases and in all individuals produced by the same apparent conjunction of circumstances. Convulsions are not an invariable result of the presence of lumbrici in the intestinal canal, but no one disputes the fact that they do occasionally produce the reflex phenomena in question. Probably there is a predisposition or diathesis involved—a greater excitability in some cases than in others.

A noteworthy fact must further be stated. It will be observed in cases of liability to paroxysmal attacks, that physical exertion, such as would be likely to exaggerate the existing flexions, is in these cases almost always found to produce hysterical phenomena. There is, in fact, a constant experiment going on before the eyes of the observer, and the patient has only to be questioned as to her daily experience to extract facts which bear out the accuracy of the foregoing statements.

It is further to be remarked, that convulsive attacks, non-hysterical in character, are observed in certain rare cases to be produced by uterine flexion. Such convulsive attacks resemble hysterical attacks in the mode of their production—temporary exaggeration of the existing flexion being their exciting cause—and in point of fact it is difficult to draw a line between these and ordinary hysterical convulsive attacks. The attacks are in both cases the result of irritation in the uterus acting in a reflex way on the spinal system, and thus exciting convulsive movements.

The recent writings of Professor Char-

[1] See, for the other side of this question, article "Hysteria."—EDITOR.

[1] See also author's work on Diseases of Women, 3d edition, p. 306.

cot on the subject of hysteria have attracted much attention. Professor Charcot apparently considers the ovaries the seat of the morbid irritation. The author regrets that as yet he has had no opportunity of personally investigating the causes on which Professor Charcot founds his conclusions.

Nausea and Vomiting.—There are few cases in which the uterus is the seat of disease in which nausea or tendency to vomiting is not observed. The sympathies existing between the uterus and the stomach have been long known and recognized, but it is not yet so generally well known as it deserves to be that sickness or nausea are very commonly symptoms of uterine disorder.

This symptom is observed in all degrees of intensity. The nausea or sickness is sometimes very slight, only noticed perhaps on first moving in the morning; or it may be so severe that the patient is on the point of perishing from the long-continued deprivation of food. In other cases the slight but more or less constant nausea present has the effect of producing a slow but very insidious form of starvation.

The particular condition of the uterus, which most commonly gives rise to nausea or vomiting, is alteration of its shape. Marked flexions of the uterus are almost invariably attended with nausea or vomiting, and those cases in which it is most marked are the cases attended with most congestion of the uterus and most disturbance of the circulation within its tissues. The imperfectly nourished uterus, which is soft and pliable to an unusual degree, and which readily bends when the patient moves or exerts herself, frequently produces a chronic liability to nausea which is most characteristic. Nausea and vomiting may doubtless be produced by other morbid conditions of the uterus, for instance, in some cases of fibroid tumor, the symptom is observed. In cancer of the uterus, sickness is often a marked symptom. Again, certain affections of the ovary—notably marked displacement of the ovary—may occasion it, but these other operative causes are of not very frequent occurrence.

The clinical proofs of the connection existing between uterine flexions and nausea and vomiting, as cause and effect, are, according to the author's experience, most convincing. The symptom in question is not invariably present in cases of uterine flexion, but it may be asserted that when marked sickness is present in association with uterine disease, the particular disease present will almost invariably be found to be acute flexion of the organ. It will be found further in such cases that every movement of the body calculated to intensify or aggravate the existing flexion, will assuredly increase the vomiting or nausea. The erect position is sufficient in many cases to produce it; hence the occurrence of nausea on first rising in the morning. While, on the other hand, the nausea or vomiting ceases, or undergoes marked mitigation under opposite circumstances—when, that is to say, the patient is made to rest in such a position that the flexion is relieved.

Severe sickness is occasionally observed at the menstrual period in conjunction with marked dysmenorrhœa. The vomiting is sometimes most intense and distressing. It appears to be due to the combined effects of the distension of the uterine cavity with retained blood and increased compression of the uterine tissues at the seat of the flexion. The diagnosis of uterine sickness from other varieties of the affection is generally a matter of no difficulty. One characteristic of uterine sickness is that it is brought on by some motion of the body, rising in the morning, stooping, sitting at table, standing or walking, and that it subsides or does not occur at all when the patient remains in the recumbent position. But in cases of retroflexion of the uterus causing sickness, the sickness goes on notwithstanding the fact that the patient is lying down. A distinction must be drawn, therefore, and it is remarkable how accurately in many cases a diagnosis may be made as to the nature of the malady from the effect of change of position on the sickness. Thus in cases of anteflexion the sickness does not occur while the patient is in the dorsal position. On the other hand, the sickness is abated almost immediately in a case of retroflexion of the uterus by placing the patient in the prone position.

The nausea or vomiting above described appears to be the result of reflex irritation starting from the uterus. The particular nature of the irritation thus potent in exciting the gastric symptom in question, is an interesting question. Assuming that flexion of the uterus is the cause, it remains to explain how and why it is that the flexion operates in this way. The author is decidedly of opinion that the compression of the uterine tissues, including the nervous fibres therein contained at the seat of the flexion, is its essential cause. That mechanical compression of such nervous fibres as exist in the tissues situated at the central part of the uterus around the internal os uteri, must ensue when acute flexion occurs is a matter which admits of no doubt. All clinical evidence, too, is in favor of the conclusion that this part of the uterus is often in a state of very undue sensitiveness in cases of flexion, as proved by the use of the sound. The subsidence of the

sickness on straightening the uterus is also in favor of this view of the matter. Besides compression at the seat of the flexion, there is stretching and distension of uterine tissue (involving also nerves) at other situations, in consequence of the congestive and circulatory obstruction. It might be properly argued that reflex irritation would be likely to be set up by such tension of the uterine tissues generally, and it must be admitted that this is a possible additional cause of irritation.

INFLAMMATION OF THE UTERUS.[1]—METRITIS.

By W. O. Priestley, M.D., F.R.C.P.

Like other organs in the body the uterus is liable to congestion and inflammation, and in its course the inflammation may be acute or chronic.

Congestion of the Uterus.—Although it may reasonably be doubted whether an organ simply congested can be described as in a state of inflammation, it is sufficiently established that congestion or hyperæmia constitutes the first step in the inflammatory process, and that but a slight interval, characterized by more intense action, separates congestion from inflammation, and the formation of those products which are usually associated with inflammation.

The uterus, from its anatomical relations and the peculiarity of its functions, is especially liable to congestion. In healthy women, as each monthly period comes round, there is a large influx of blood to the uterus and neighboring parts, in connection with the periodic and regular maturation of ovules, or "spontaneous ovulation," as it has been termed. The production of the catamenial flow is the result, and after its persistence for a certain number of days the congestion subsides, and the parts return to their ordinary quiescence. Should anything occur to disturb the regular and proper performance of this physiological process, the uterine congestion, which within certain limits is normal and salutary, may readily be pushed beyond the confines of health, and become morbid. Thus, as the result of functional derangement, or of displacement, or of organic disease in the womb and its appendages, more than the due amount of blood may distend the vessels at the catamenial periods, and instead of the usual moderate menstrual flow, a discharge of blood occurs, which, both on account of its amount and persistence may be characterized as hemorrhage. Or, as the result of the same class of causes, the loss of blood at the menstrual periods is not only abnormally large, but the recurrence of what should be the periodic flow becomes irregular and too frequently repeated. Again, if only the normal amount of blood is sent to the tissues of the uterus and any cause prevents the proper elimination and secretion of the catamenia, by which the congestion is relieved, the uterus will remain large in bulk, and increasing as each month returns, by a repetition of the same events, it will gradually become hypertrophied.

The consequence, therefore, of persistent or frequently repeated attacks of morbid congestion is that the uterus becomes permanently enlarged, and as its substance is composed of dormant elements readily developed into more mature structures, the steady influx of blood eventually gives rise to a genuine hypertrophy. Besides the increase in bulk the tissue then becomes harder and denser and more resisting to the knife. According to Virchow this condition is due to increase in the amount of connective tissue, and Dr. Thomas consequently proposes to give it the appellation of "chronic hyperplasia," to distinguish it from inflammation. Scanzoni, on the other hand, believes that the muscular element is also augmented.

This hypertrophy may affect equally the body and cervix of the womb, the whole organ becoming larger and heavier; or it may affect a limited portion, as one or both labia uteri, singly or together. The cervix has been observed so equally enlarged in its lateral dimensions, as to form a considerable tumor in the vagina, and press inconveniently on the rectum. In one remarkable form of this local hypertrophy which has recently attracted much attention and is not infrequent, the whole cervix is so enlarged downwards, without the appearance of other morbid change, as closely to simulate prolapsus uteri, the os uteri in some cases project-

[1] This article was written in 1872–73.

ing beyond the vaginal orifice, while the fundus maintains its normal position in the pelvis. This form of hypertrophy has been especially described by Virchow and M. Huguier. Closely allied is a form of uterine hypertrophy produced by defective involution of the uterus after delivery. In this, the process by which the womb is reduced to the size of the unimpregnated organ is suspended or arrested, and the organ remains large, heavy, and relaxed, with its cavity elongated and its vessels overdistended. It has been supposed that the supervention of puerperal inflammation in the early days after childbirth is concerned in the production of this condition, and no doubt this is so in some cases, but in a large number of instances it occurs where there has been no history of preceding inflammation, and where the fault seems to have arisen from imperfect contraction of the uterine fibres, combined with feeble reparative power peculiar to the constitution of the patient. Such a state of the uterus exists more frequently after abortion than after delivery at the full period, and it can readily be understood that the weakness of its tissue predisposes to uterine congestion and inflammation, while the increase in size predisposes to displacement.

Dr. Thomas, who has devoted much intelligent consideration to this subject, believes that a large proportion of cases called chronic parenchymatous metritis are really later stages of sub-involution; and that the persistent hyperæmia present in the early stage of this condition engenders "hyperplasia," or increase of the connective tissue as a result of a vice of nutrition without really partaking of the character of an inflammatory process. Persistent hyperæmia arising from other causes may possibly produce a like hyperplasia in the nulliparous uterus, but such a result is infrequent. When, however, the uterus has once undergone the development of pregnancy, areolar hyperplasia may be induced at any time, by displacement, endometritis, or by other conditions producing continued hyperæmia, without the previous existence of sub-involution.

Acute Metritis. — Acute inflammation may attack any of the three coats of the uterus, or all conjointly.

1. *Serous or Peritoneal Coat.*—When the serous or outer covering is inflamed, it is generally by extension through the structures beneath, or by continuity from the broad ligaments on each side. In either case the affection becomes one of the forms of *pelvic peritonitis*, and the reader is referred to the article on that subject.

2. *Middle or Fibrous Coat.*—Acute inflammation of the parenchyma of the uterus is met with in its most characteristic form in connection with the puerperal state. Occurring after delivery, it is, however, in most cases rather the localization of a constitutional affection; general blood-poisoning preceding or at least being intimately associated with it. The pathological results observed are intense hyperæmia, swelling and œdema, with softening of the tissues of the uterus. The os and cervix uteri commonly appear as if contused and ecchymosed. When the morbid action has been great and the attack sufficiently prolonged, the uterine cavity may contain pus mixed with the lochia. The inner surface of the organ presents a deep livid or purple color, particularly at the placental spot, where shreds of decidual and uterine tissue appear almost gangrenous. The middle coat is thickened, soft and friable, and infiltrated with blood and pus; and the peritoneal surface and broad ligaments are covered with a low form of lymphy exudation, probably mixed with imperfectly-formed pus. The dilated blood-vessels are frequently observed to have their coats inflamed, and to contain coagula in all stages of disintegration mixed with pus. The lymphatics, even more distinctly, may be seen distended with pus, and in some cases may be traced beneath the peritoneum, from the uterus to the broad ligaments, and thence upwards to the larger lymphatic ducts and glands lying in front of the vertebral column. Graphic illustrations of these morbid conditions are to be found in Cruveilhier's "Morbid Anatomy."

Virchow has described a puerperal form of inflammation, which he designates "diffuse puerperal metritis," and which prevails when epidemic influences are in operation, the whole affection bearing the greatest possible resemblance to erysipelas and pseudo-erysipelas on the surface of the body.

In the unimpregnated uterus, acute inflammation of the parenchyma, of the idiopathic form, is comparatively rare. The modern practice of treating many affections of the uterus by surgical proceedings, some of them being of a grave and severe character, has considerably increased the frequency of what may be termed acute traumatic inflammation. Thus attempts to enucleate fibroid tumors and extensive divisions of the cervix, have been followed by acute parenchymatous metritis and peritonitis, in some instances ending fatally. A peculiarity deserving notice in reference to these results of operations on the uterus is, that the inflammary attack does not always immediately succeed the operation, but often lies dormant for many days, and then without appreciable cause suddenly develops itself. Thus not infrequently a patient has seemed to progress favorably for five, six, or more days, after an opera-

tion on the uterus, when suddenly acute inflammatory symptoms burst forth, giving all the evidences in a short time of a matured attack of metritis or metro-peritonitis. The explanation is probably to be found in the inactive condition of the chief elements composing the uterine walls in the unimpregnated condition. This necessitates the lapse of a certain time to develop the phenomena of inflammation, but when once a certain momentum is attained, the morbid changes go on rapidly, and as the peritoneal covering becomes involved, the pain and tenderness give unequivocal evidence of the nature of the attack. Or it may be that the inflammatory action slowly passes along the mucous coat, through the uterine cavity and Fallopian tubes, until it reaches the peritoneum, and then declares itself by prominent signs.

The practical deduction is that operations involving deep incisions into the uterine substance should not be lightly undertaken, and in those cases where absolutely necessary, the patient should be kept perfectly at rest for a sufficiently long period to insure immunity from inflammation; further the practitioner should not be lulled into a false security against untoward consequences because no indications of mischief present themselves during the early days succeeding the surgical procedure.

The inflammation in these cases is rarely limited to the uterus itself. Most frequently it is complicated both by peritonitis, ovaritis, and cellulitis, and if the affection attains any considerable intensity the womb speedily becomes fixed in the pelvis, partly by the lymphy exudation on its peritoneal surface, which glues it to neighboring structures, and partly by lymph poured out into the meshes of the cellular tissue of the pelvis. The adhesions thus formed often assume more or less of a permanent character, and by thickening the *indusium* of the ovaries and distorting and occluding the Fallopian tubes, may interfere with the functions of menstruation and conception; or by fixing the uterus firmly in the pelvis prevent its proper expansion should conception occur, and thus lead to inevitable abortion. Abscesses have been found in the walls of the uterus after acute inflammation, but these are generally of small dimensions, the larger abscesses found associated with metritis being generally situated in the pelvic cellular tissue.

3. *Mucous Coat.*—Acute inflammation of the mucous membrane of the uterus or acute endometritis is commonly the precursor of inflammation of the other coverings of the organ, and this probably because it is more accessible to external agencies and injuries. It is always present when the parenchymatous or middle coat of the womb is inflamed, and this occurs chiefly in puerperal patients, but acute endometritis or inflammation of the mucous membrane occurs somewhat frequently in the non-puerperal uterus. In these cases, the submucous layer of connective tissue and the strata of the contractile coat which lie nearest to the mucous surface are commonly more or less affected, but the inflammatory process may not penetrate deeply into the thickness of the middle coat, unless action is very intense. Acute endometritis is not uncommon in the progress of exanthematous fevers, giving rise to profuse and painful leucorrhœa, and probably remaining after the fever has passed, in the form of chronic endometritis. This has been called by Kiwisch "metastatic constitutional catarrh." It may occur also as the result of a sudden check to the progress of menstruation. Perhaps the most frequent form in the unimpregnated uterus is that produced by gonorrhœa, which has extended upwards from the vagina and urethra. The morbid process may affect only the cavity of the cervix, or it may run along into the proper uterine cavity, traverse the Fallopian tubes, and eventually light up pelvic peritonitis. When menstruation is suddenly checked inflammation commences in the interior of the womb. In puerperal cases it probably has its starting point also in the uterine cavity, and in the vicinity of the placental spot. When provoked by gonorrhœa, or it extends in any way from the vagina, it begins at the os uteri and makes its way upwards. The effect of acute inflammation is to produce intense redness of the mucous membrane, and the hyperæmia is followed by softening and œdema. It is easier then than in the normal state to separate the mucous from the subjacent layer, and some portions look rough and ragged as if partly exfoliated. Scanzoni states that the surface is often spotted with bright red, the red places corresponding to the artificial openings of the utricular glands, which are surrounded by a fine capillary network very strongly injected. The uterine cavity generally contains an undue quantity of liquid, consisting of mucus or muco-pus, sometimes reddened by blood, sometimes like cream. There is usually more or less congestive swelling of the muscular coat of the womb at the same time, and the layers next the mucous membrane are gorged with blood. Here there may be the infiltration and softening characteristic of parenchymatous metritis, and it extends the deeper in proportion to the intensity of the morbid action on the mucous surface. Klob says the whole substance of the uterus appears to be increased. The same changes are observed in the canal of the cervix, though perhaps in a less marked degree

than in the body. The os looks tumid, its labia puffy, and the papilla, deprived of their epithelium, stand out, producing the appearance of a granular abrasion.

Chronic Metritis.—Chronic inflammation of the uterus differs from the more acute form, not only in its less rapid progress and the less severe symptoms by which it is accompanied, but it differs also in reference to certain pathological results which are observed in association with the tardier morbific process.

1. *Peritoneal Coat.*—Chronic inflammation of the peritoneal coat of the uterus is comparatively of less pathological importance than chronic inflammation of the other coats, and probably rarely occurs except as a secondary result of inflammation in the adjacent structures or as an extension of a more general peritonitis. The results observed consist chiefly of lymph exudations on the free surface of the membrane, occasionally thrown out so copiously as to glue the various appendages of the uterus together, and to produce adhesions between the uterus and large and small intestines. A sufficiently common illustration of this effect is familiar to the uterine pathologist in the frequently observed union between the posterior surface of the uterus and the front of the rectum, the adhesion being so close in some cases that separation is impossible, and the functions of both organs are alike impeded by the union, or are performed with difficulty and discomfort. Occasionally, too, in cases of retroflexion, the fundus uteri becomes adherent to the anterior surface of the rectum, and the replacement of the womb, either by the finger or sound, is thus prevented so long as the adhesions exist. It is a curious fact that these adhesions are often found when there is no distinct history of previous acute inflammatory symptoms.

2. *Middle Coat.*—Chronic inflammation of the middle coat or parenchymatous structure of the uterus is generally an extension from the mucous coat and produces thickening and induration of the tissue, bearing some sort of relation to the duration of the morbid process and the amount of inflammatory action. This condition differs somewhat from the slower hypertrophy which arises from chronic hyperæmia, and has been called "areolar hyperplasia" by Dr. Thomas, inasmuch as it is attended by inflammatory exudation into the parenchymatous structure, and may, in some cases, give rise to considerable intumescence, produced more speedily than chronic hyperplasia, and more amenable to subsequent removal. The immediate effect is the infiltration of liquor sanguinis into the meshes of the uterine structure. At first the whole substance of the coat is softer and less resisting from the fact that not only is the interstitial deposit plastic in its character, but the elementary fibres are themselves softened by the inflammatory action. After a time a certain shrinking and solidification succeeds, by which the parenchyma becomes much firmer than in health, and if the process be continued or the attack often repeated, the whole thickness of the walls becomes permanently increased outwards, by the growth of connective tissue, as in hyperplasia, while from the shrinking afterwards, the cavity becomes elongated and enlarged after the fashion of the ventricles in eccentric hypertrophy of the heart. The hypertrophy produced by chronic inflammation may be general, producing an equable enlargement of the entire womb, or it may be partial and limited, affecting only a portion of the organ. Sometimes the fundus only has its bulk increased, and as the effect of its greater weight, it may fall forward upon the bladder or backwards upon the rectum. This is not invariably the result of enlargement of the fundus, but when it does occur hypertrophy becomes complicated with displacement. The commonest form of partial hypertrophy met with in practice, so far as the supra-vaginal division of the uterus is concerned, is an enlargement or undue prominence of the posterior wall, the projection being so great in some instances as to have led Dr. Oldham[1] to suppose that it was frequently mistaken for retroflexion of the womb. More rarely the enlargement takes the form of masses which project as nodules of variable size from the outer surface of the uterus, and may be distinctly felt through the abdominal walls. Instances have been observed in which the irregular inflammatory deposit on the outer surface of the uterus reached the bulk of a large orange, but having a more irregular and nodular outline, simulating in form and relations some of the varieties of fibroid tumor, but obviously not of that nature, as proved by its complete disappearance under treatment. In these cases it is probable that some of the swelling is produced by simultaneous inflammatory exudation into the sub-peritoneal cellular tissue which surrounds the middle coat of the uterus, and this conjecture receives confirmation from the fact, that large inflammatory tumors of this character are more commonly observed towards the lateral borders of the organ, where cellular tissue is more abundant than elsewhere. Abscess in the parenchyma of the uterus, produced by chronic metritis is extremely rare.

The cervix, however, is principally or exclusively the seat of enlargement, from chronic inflammation in the largest number of cases. Occasionally one lip only is

[1] Guy's Hospital Reports.

affected, in which case it becomes broader, more prominent, and projects lower into the vagina than the other. In other instances the whole vaginal portion of the cervix is implicated, both labia being extended in breadth, and being considerably elongated. In women who have borne children and in whom the os uteri may have been fissured during parturition the hypertrophy may be more or less lobulated in its character. It may be remarked that in the lobular or irregular hypertrophy of the cervix which has been produced by simple inflammation, the intervening sulci or fissures commonly radiate from the os uteri as a centre, while in contradistinction to this, the lobulation of the cervix in the earlier stages of malignant disease, is, as a rule, more irregular, the sulci having no such definite arrangement or tendency to converge to the os tincæ. A form of hypertrophy of the cervix with lobulation, in the production of which, chronic inflammation probably plays an important part, is that in which mucous cysts constitute a large portion of the projecting mass. In some of these cases, not only is the muscular structure and connective tissue of the cervix increased to a large amount, but the mucous follicles or glandulæ nabothi undergo an abnormal development, and the superficial ones appear as firm opalescent elevations on the surface. Ordinarily, these kinds of hypertrophies are of limited extent, but instances are occasionally met with in which they grow to such an extent as to form considerable vaginal tumors, and from the irregular character of the lobulation are liable to be mistaken for malignant disease.

It may be difficult to determine in some of the forms of enlargement above described, whether they are the genuine products of inflammation or only the results of chronic and persistent hyperæmia. It is quite certain, however, that the development of some of them is preceded by exudation and is accompanied by symptoms which overstep those of mere persistent congestion, and yet which cannot be described as those of acute inflammation.

3. *Mucous Coat; Chronic Endometritis.*—At one time authors on uterine diseases commonly described the inflamed uterine mucous membrane as prone to the exudation of coagulable lymph on its free surface. It is now well known that the production of inflammatory exudation on the inner surface of the uterus, although not uncommon in the more acute attacks of metritis, associated with the puerperal state, is rare in the unimpregnated condition. The observations of Dr. Oldham, and later, those of Sir J. Y. Simpson, have conclusively proved that certain membranous structures, called "dysmenorrhœal membranes," periodically expelled from the womb, and which were taken to be portions of coagulable lymph, being erroneously compared to lymph casts from the trachea and bronchi, are really exfoliations of the mucous membrane itself, shed off under certain abnormal conditions of menstruation. A minute description of these pathological products may be more appropriately given under the head of "Dysmenorrhœa," but a passing notice can scarcely with propriety be omitted here, since the process by which they are evolved, if not essentially inflammatory, bears a close relation to it. The membranes thus expelled consist of shreds or patches of variable size and thickness, in accordance with the extent and depth of the exfoliation. Occasionally the whole superficial layer of the mucous membrane of the cavity of the womb is separated in its entirety, and represents a triangular cast of the interior of the uterus. The structure of these membranes, or shreds of membrane, is essentially the same as that of the lining membrane of the uterine cavity. The one side, representing the free surface of the membrane, is smooth, and is studded over with minute pits or depressions, which are the orifices of the mucous glands or follicles. The other side, which has been adherent to the uterine walls, is rough and flocculent, as the result of the process by which it has been torn off or detached.

In any case where the uterus forms and expels these deciduous membranes, the function of menstruation is performed with much discomfort, and the spasmodic pain which attends their extrusion towards the end of the catamenial period, is sometimes so severe, as to be compared to the throes of labor. During menstruation under these circumstances, the uterus grows abnormally heavy, and is very tender to pressure. It gives a sense of increased temperature to the touch, and its arteries can be felt beating with undue impulse and frequency. The more acute symptoms gradually subside with the departure of the period, but frequently there is more or less of *malaise* prolonged into the interval, and the womb is then commonly found more or less habitually turgid, and its tissues indurated by interstitial exudation.

Dr. West believes these so-called "dysmenorrhœal membranes" can scarcely be inflammatory products, inasmuch as the exaggerated vascular changes by which they are accompanied at the catamenial periods leave but slight changes indicative of inflammatory action in the intervals. On the other hand, it may be doubted if the womb, habitually shedding these membranes, is ever quite free from some congestion or induration, and slight though this may be, it is commonly perceptible

on examination. Scanzoni, indeed, recollects but a single woman affected with membranous dysmenorrhœa, whose uterus was not the seat of chronic engorgement, fibroid tumor, or flexion.

The late Dr. Edward Rigby believed these structures to be produced as the secondary effect on the uterus of some morbid change or irritation going on in the ovaries.

4. *Uterine Catarrh; Uterine Leucorrhœa* or *Metrorrhœa.*—This affection, which is characterized by a superabundant flow of mucus, or muco-purulent discharge from the uterus, may more accurately be described as one of the symptoms of endometritis than as a special affection by itself. It bears the same relation to inflammation of the uterine mucous coat as catarrh of other mucous surfaces does to inflammation there. It is commonly chronic in its character, but, as before stated, cases of acute endometritis attended by catarrh are not unfrequent; that produced by gonorrhœa being a familiar example, and hence, various authorities have described both an acute and chronic form of uterine catarrh, the one differing from the other only in the greater or less intensity of the associated symptoms. Many gradations may be observed between the two extremes; the more acute, as the more active symptoms subside, passing into the chronic form, and chronic endometritis, under some fresh stimulus to inflammatory action, readily lighting up into the more acute type.

The pathological changes commonly observed in the mucous membrane are much the same as in acute endometritis, but less in degree; all its capillaries become injected, and its surface presents a deep red color. The various structures soften and swell from effusion, and patches of ecchymosis may be seen here and there from the rupture of minute bloodvessels into its substance. Occasionally ulcerations have been found in the proper uterine cavity as the result of internal metritis, but these are probably rare in their occurrence. Erosions and pseudo-ulcerations are produced with comparative frequency in the cervical canal. The usual result of this perverted action is that the follicular structures become hypertrophied and the secretion of their mucus is largely increased in quantity and its characters are in some respects materially altered. The amount and quantity of the discharge vary with the stage of the inflammation and with its intensity, and the character of the secretion differs also in accordance with the portion of the uterine cavity by which it is furnished. Thus, in the early stage of a more acute attack, when vascular excitement is at its highest, all secretion may become checked, and it is not until the climax is passed that muco-purulent secretions are poured out in greater or less abundance, the appearance of the discharge being generally coincident with an amelioration of suffering. The discharge flowing from the uterine cavity is commonly muco-purulent, sometimes tinged with blood, and occasionally, truly hemorrhagic. Dr. Henry Bennet has drawn especial attention to the distinctions between inflammation of the uterine cavity proper, and inflammation of the cervical canal. The latter (endocervicitis) he believes to be a frequent affection, while the former is comparatively rare. Commonly the discharge furnished by the upper part of the uterine cavity proper is comparatively thin and limpid, while in contradistinction, that from the gland follicles of the cervical canal is gelatinous and viscid, this difference in the thickness of the secretion furnishing, in some sort, the clue to the locality from which the discharge comes. Dr. Tyler-Smith and Dr. Hassall have pointed out that the mucous membrane lining the cervical canal is furnished with a most elaborate secretory apparatus, which they have carefully delineated, and it is the peculiarity of the gland follicles in that locality to secrete a thick viscid mucous which forms a plug to seal the os uteri in normal pregnancy, but which may also be poured out in undue abundance from disease in the unimpregnated condition. Dr. Henry Bennet avers that the discharge from the uterine cavity in endometritis is often more or less mixed with blood so as to have a rust-colored appearance, especially for a fortnight after menstruation. This he looks upon as being "as characteristic of internal metritis as the rust-colored expectoration is of pneumonia,"—a statement requiring some qualification, as it is not by any means a constant sign. As pointed out by Dr. Thomas, there is a variety of corporeal endometritis, sometimes involving also the vagina, which occurs in old women, after menstruation has ceased, in which a watery or creamy pus is secreted, which is very irritating, and a like affection is observed sometimes in younger women. The secretions of the uterine cavity have ordinarily an alkaline reaction, and thus if clear and pellucid as they ooze from the os uteri, they become opaque by the admixture with the acid mucus of the vagina. Both the alkalinity of the uterine secretion and the acidity of the vaginal mucus are apt to be exaggerated by the inflammatory process, and Donné avers that in either case spermatozoa are killed after coitus. Hence sterility is observed with existing inflammation of the mucous membrane lining the genital tracks, and pregnancy occurs when it is cured. As in the more acute attacks, the parenchymatous structure rarely escapes partici-

pating in the inflammatory action, so even in the more chronic forms, induration and thickening of the uterine substance is frequently associated with the morbid changes in the mucous membrane. The cavity then becomes expanded both in its lateral and longitudinal dimensions; the os internum widens, and the sound passes more easily, and, it may be, penetrates an inch or more deeper than ordinarily. There is, however, a large class of chronic cases in which but comparatively little alteration is noticeable in the deeper uterine structures, and yet where the catarrh is both profuse and obstinate. In most of these instances the catarrh is from the cervical canal. There the labia uteri are usually more or less tumid and pouting, and the os externum is expanded, the whole cervical canal being larger, and filled with a dense mass of adhesive mucus which projects from the os uteri and is dislodged with difficulty. Occasionally cervical catarrh is associated with marked stricture of the os and cervical canal. When the inflammation is confined to the cavity of the cervix, the os uteri internum retains the contraction which is found under normal circumstances and the sound encounters the usual obstruction there. Great circumspection is however necessary in the use of the sound, as the uterine cavity when inflamed is commonly very sensitive, and the mucous membrane often bleeds profusely when touched by a probe or other instrument. The catarrh is often associated with abrasion or granular inflammation around the os uteri, the discharge by its acrid property irritating the mucous membrane there, and causing it to shed its epithelial covering. The frequency of abrasion in conjunction with uterine leucorrhœa induced M. Huguier and Dr. Tyler-Smith to advance the hypothesis (which will be again referred to), that abrasion and ulceration of the os uteri are mainly due to hypersecretion from the cervical cavity. The presence of abrasion around the os uteri in cases of uterine catarrh is nevertheless by no means constant, instances being frequently observed where it is absent, notwithstanding an abundant hypersecretion habitually poured from the uterine orifice.

5. *Abrasion, Granular Inflammation, Erosion, Ulceration*, of the mucous coat.

These conditions, which commonly affect the mucous membrane round the os uteri, have been the occasion of much debate among uterine pathologists, and great diversities of opinion have been expressed, both in reference to their exact definition, their nature and character, and also concerning their pathological importance. Dr. Henry Bennet, Dr. Tilt, and others consider all to be varieties of inflammatory ulceration, the terms abrasion, granular inflammation, and ulceration representing a progressive series of pathological changes which reach their climax when completed. Other observers, among whom may be enumerated Dr. E. Rigby, Dr. Snow-Beck, Sir James Paget, and Dr. Arthur Farre, regard simple erosion and granular inflammation as having no claim to be classified as varieties of ulceration, and as possessing none of its essential characteristics, such as the loss of the vascular and parenchymatous tissues. Some authors again hold that inflammation and ulceration of the cervical mucous membrane have a primary importance at one time unsuspected, that, having mainly a local origin, they affect materially not only the comfort, but the general health of the subjects of them, are the parents of other diseases, and, as a natural corollary, demand chiefly local treatment.

In opposition to this view the evidence of prolonged and careful observation has been adduced to show, that an undue importance has been attached to simple ulcerations of the os uteri; and that admitting their frequency, in a large proportion of cases they give but little evidence of their presence, are attended with but slight local inconvenience, and are rather to be looked upon as complications of some more important ailment, or as evidences of some constitutional derangement, than as primary affections, having an essential local origin. The contention concerning the definition of uterine ulceration has mainly taken place because an erroneous impression gained considerable currency, that the presence of ulceration once determined, frequent instrumental examinations and cauterization are necessary. It is however obviously undesirable to multiply terms and definitions because some practitioners persist in taking an overstrained view of the importance of these pathological changes, and pursue methods of cure which may be entirely uncalled for by the circumstances. Studied as pathological phenomena and apart from doctrinal views, the changes taking place in the mucous membrane of the os and cervix uteri, when affected by chronic inflammation, may generally be said to be the following:—The membrane becomes swollen and puffy, and the minute vessels beneath the surface are unduly injected. The last stage indeed is that of hyperæmia or congestion. If action goes beyond this, the squamous epithelial particles lying most superficially become cloudy and opalescent, and losing their cohesion, are shed off singly, or in patches to mingle with the mucus of the genital passages. The papillæ beneath, thus denuded of their outer covering, present a red velvety appearance, readily bleed when touched, and if nitrate of silver be

applied are at once covered with a white film from the production of the chloride of silver. This effect is less noticeable where the epithelium is entire. These changes, which constitute *abrasion* or *erosion*, are observed immediately around the os uteri, in a ring of varying breadth, but they are sometimes seen on other parts of the cervix, and, not infrequently, groups of red and inflamed villi, denuded of epithelium, are seen scattered over the whole mucous membrane of the vaginal portion of the cervix, looking at first like numerous spots of acne, but eventually becoming isolated or confluent patches of abrasion. The erosions or abrasions thus produced are sometimes smooth and uniform on the surface, and then resemble those produced by mechanical attrition; at other times they are irregular and worm-eaten in appearance from the unequal way in which the epithelium has been exfoliated—bundles of filiform papillæ projecting on the surface, and small pits or depressions being readily discerned, caused by the epithelium being emptied out of the mucous crypts and follicles. The abrasion when limited to one uterine lip is, in the largest number of cases, but not exclusively, situated on the posterior one, and whether partial or completely encircling the os uteri, commonly is associated with some dilatation of the orifice. When the labia uteri are separated the erosion is seen to run up the cervical canal as far as it can be examined, giving rise to copious muco- or muco-purulent discharge—being complicated in fact with inflammation of the cervical canal and catarrh. Various eruptions analogous to those observed on the skin have been described as associated with these simple abrasions. Thus acne, herpes, and lepra have been mentioned as occurring on the cervix uteri, and these in the later stages of their progress leave erosions of the mucous membrane. The best recognized eruption in this locality is the herpetic form, in which one or several flattened vesicles form on the surface of the previously congested mucous membrane, and eventually burst, leaving abrasion beneath. Herpetic vesicles are apt to be mistaken for mere chronic distensions of the glandulæ nabothii, several of which sometimes coexist, varying in size from a millet seed to a pea, and project irregularly from the surface of the cervical mucous membrane. In some instances the epithelium is detached in small patches, the intervening tissue being healthy or only somewhat redder than natural. The mucous membrane then seems beset with minute aphthous ulcerations, similar to those observed in the mouth and elsewhere. MM. Boys de Loury and Costilhés, M. Robert, Drs. Tilt, Matthews Duncan and others have described a diphtheritic or pseudo-membranous exudation of the cervix uteri and vagina, which is usually accompanied with superficial inflammation of the parts, and which, on removal, leaves loss of epithelium and abrasion beneath. Under the microscope these membranes are found to consist of delicate fibrillæ and epithelium, and they are bounded by a red inclosing line with elevated margins, which makes them easily mistaken for deeper ulcerations.

Should hyperæmia proceed beyond the production of mere abrasion, *granular inflammation* or *ulceration* follows. The erectile papillæ having lost entirely or in great part the epithelial covering which normally binds them down, and having received fresh impetus to growth, present a vivid red color, and an appearance of prominent granulations. These granulations are either on a level with or project somewhat above the general surface, and are bounded by the surrounding sound mucous membrane, which either preserves its natural color or assumes a somewhat deeper red in the immediate vicinity. Occasionally the granulations are so exuberant as to assume a fungoid appearance. They then readily bleed, are probably more or less sensitive to the touch, and have a slightly indurated raised border, with a vivid red boundary line running just within it. This condition, if persistent, is nearly always associated with some degree of thickening in the subjacent structure of the cervix, and hence the labia look puffy and swollen, and often deep sulci radiating from the uterine orifice divide them into lobules, in such a way as to make the granulations appear still more prominent. One of these varieties of exuberant granulation has been termed "cock's-comb" granulation from the supposed resemblance to a cock's-comb. Dr. Arthur Farre has pointed out that one effect of inflammatory action is to produce eversion of the hypertrophied mucous membrane in the cervical canal, and that this is apt to be mistaken for a more genuine form of ulceration. In these cases the apparent unevenness and rawness of the surface, the prominence of the rugæ, and the recession outwards of the natural boundary line forming the os uteri externum, all conduce to produce the appearance of ulceration. Somewhat more rarely occur those forms of ulceration in which the surface is depressed below the general level of the mucous membrane. Instances of distinct excavation with loss of the deeper structures as the result of simple inflammatory action are not frequently met with when the uterus is *in situ;* but in prolapsus, where the cervix is habitually exposed to external agencies, and kept constantly dry, it is by no means uncommon to find around

the os an excavated ulcer so well defined and limited, that it might have been dissected out with a knife.

When any considerable thickening of the labia uteri takes place as the result of persistent hyperæmia associated with the ulcerative process, the microscope shows that there is not only hypertrophy of the contractile structures, but an especial increase of the connective tissue. This gives a greater density to the cervix, and if the closed follicles or glandulæ nabothii become distended and project at intervals over the surface, as occasionally happens, a very marked feeling of irregularity is observed on making a digital examination. The partial hypertrophies assume a diversity of forms. In one often observed, there is a projection varying in size from a split pea to a cherry, on the inner side of one of the labia towards the os uteri. If the opposite lip then remains sound, it is thinned out and spread over the nodule. On the most prominent point there is usually marked erosion, while elsewhere in the vicinity there is much vascular injection, and copious muco-purulent or sanguineous discharge is poured out from the surface,

The general color of the cervix affected by these morbid changes varies exceedingly. Sometimes the mucous membrane surrounding the inflammatory patch deviates but little in this respect from its normal appearance. It may indeed be pale and anæmic, affording evidence of feeble circulation and defective power. Occasionally, however, both ulceration and surrounding parts are of a deep violet or purple hue, like the appearance of the cervix and vagina in pregnancy; and there are further indications of intense venous congestion in a varicose condition of the smaller veins there. Hence the appellation of "varicose" ulcer of the cervix employed by French and other writers.

The varieties in the way of intensity, extent, and appearance presented by these pseudo and true ulcerations are so considerable, that attempts have been made to classify them, like surgical ulcers of the legs for example, but without any obvious practical advantage.

In some instances of chronic inflammation of the mucous membrane covering the cervix, no abrasion or ulceration takes place. The surface, without any breach of continuity, exhibits everywhere a deep red color—has a finely granular appearance and is swollen and œdematous. In this condition the vaginal walls often take part, and the rugæ there become hypertrophied and prominent. The copious muco-purulent discharge secreted by the whole surface, and the pruritus and excoriation of the external parts from the acridity of the secretion, may raise the suspicion that it is gonorrhœal in character, more particularly as it may be the cause of a mild form of blennorrhagia in the male. The frequency of its repetition, however, in the same subject, the readiness with which it is reproduced by slight causes, its persistence in some patients even throughout pregnancy, and lastly its association with a gouty or rheumatic diathesis or with the various forms of dyspepsia and with acne on the face, all point distinctly to a constitutional origin. This variety of chronic inflammation is frequently observed in women who have passed the climacteric period of life.

As to the way in which abrasions and ulcerations are produced, and the order of the several pathological phenomena, various hypotheses have been advanced. One school of authorities, of which Dr. Henry Bennet is the able exponent, holds that when the uterus is the seat of chronic inflammation, the os and cervix are the *points de depart*, and the result of that inflammation is ulceration there, attended with muco-purulent discharge, and hypertrophy later. M. Huguier and Dr. Tyler-Smith believe that the canal of the cervix uteri is the more frequent seat of inflammatory action in the first instance. Dr. Tyler-Smith maintained that it is here primarily that the phenomena of hypersecretion and inflammation are most commonly observed, and that the flow of the perverted mucus from the os uteri produces abrasion and ulceration in the surrounding parts, these later changes therefore being secondary to the affection of the cervical canal. Dr. West in his admirable "Lectures" considers both these theories as expressing a too partial view of the subject, and urges that if any part of the womb has a pathological importance above the rest, it is the mucous membrane lining the true cavity of the womb. It is this that undergoes the greatest changes during the whole child-bearing period of life, and it is the condition of this portion which at all times influences the rest of the womb more than any other part. In the majority of inflammatory uterine ailments, "it is the interior of the uterine cavity which suffers first; it is thence that the hemorrhages are derived; thence that the greater part of the leucorrhœal discharge is furnished; and it is the irritation of that part of the organ that leads to the increase of its size, so apparent in the large proportion of cases of long-continued uterine ailment." Dr. West indeed holds that, as a general rule, there is no proof of the point of departure of the mischief being in the neck of the womb, more than its orifice, or appendages. Dr. West's investigations have done much to prove the comparatively small importance of

abrasion and ulceration of the womb *per se;* and that when these are attended with any serious results, there is generally some superadded morbid condition of the cavity or walls of the womb, which is more directly concerned in their production. After the first introduction of the speculum uteri, by means of which practitioners were for the first time exactly informed concerning the presence and frequency of these alterations of the os and cervix, it was perhaps very natural that their importance should be overrated, and it was supposed discoveries had been made enough to account for all the hitherto obscure forms of uneasiness in the region of the womb. The progress of time, and the accumulation of more accurate observations, have since done much to moderate this estimate, and confine it to more precise limits. It is now very generally conceded that but little importance is to be attached to the slighter forms of erosion or ulceration of the cervix in the majority of cases; that when present without other complication, they rarely exercise any considerable influence on the patient's health and comfort, but are rather indications of feeble power, or are superadditions to some other pathological change. It is equally admitted, that some of the severer forms of inflammatory ulceration, beginning it may be as local ailments, and particularly when associated with hypertrophy and induration, are sufficient to cause much suffering, and may seriously impair the general health. In some instances, indeed, a slight and superficial abrasion becomes the seat of very undue sensitiveness, rendering the exercise of the generative functions painful. These cases are nevertheless exceptional, and, in patients the subjects of them, there are generally other points in the uterine substance, where no abrasion exists, almost equally painful to the touch.

Under the appellation of "irritable uterus," the late Dr. Gooch described a condition in which the womb was so exquisitely tender and so sensitive to motion, that the slightest touch or movement of the body produced distress, and yet on examination the organ was found unchanged in structure. As the result, the patient became "reduced in flesh and health, almost living on her sofa for months, or even years, from a constant pain in the uterus, which rendered her unable to sit up and take exercise." The proclivity of patients so suffering to take large and increasing doses of opium rather aggravated the malady, and tended to make it incurable.

It has been suggested that cases of "irritable uterus" are really cases of chronic inflammation in which the organic changes are less obvious than usual. Dr. Graily Hewitt, again, believes that some of Dr. Gooch's worst cases were instances of uterine flexion. The natural history and results of examination point rather to its being a form of uterine neuralgia, and Dr. Gooch and Sir Charles Locock noticed that it was habitually associated with a rheumatic or gouty diathesis.

ETIOLOGY.—The *causes* of acute metritis, besides those associated with the puerperal state, are sudden suppression of the catamenia from exposure to cold, either atmospheric or in the form of cold baths; the injudicious use of vaginal injections at unseasonable times or when too strongly medicated; the action of certain emmenagogues; operations on the uterus, and the use of strong escharotics; the incautious use of the uterine sound, and the employment of intra-uterine pessaries and expanding tents; physical injuries, and too frequent coitus, or sexual intercourse accompanied by undue violence. The first attempts at coitus after marriage in some sensitive women have been known to produce it. Again, the extension of gonorrhœal inflammation from the vagina may involve the uterus, Fallopian tubes, and ovaries, and light up acute inflammation there, and in this form the action is commonly met with in great severity. Lastly, the inflammatory action may originate in the ovaries, and pass by sympathy and contiguity to the womb itself.

The causes of uterine congestion and chronic inflammation may be described as indirect and direct. Under the first head may be classed natural feebleness of constitution; unhealthy conditions of life; impoverished conditions of the blood; the various ailments which obstruct the venous circulation above, and lead to passive congestion of all the pelvic organs. Among these may be enumerated certain forms of disease of the heart, lungs, and kidneys; habitual derangement of the liver and chylopoietic viscera; constipation and abdominal tumors. Women who are the subjects of saccharine diabetes seem particularly prone to uterine congestion. The direct causes are—any agencies which produce partial or entire suppression of the catamenia, or other derangement of the menstrual function; the various accidents associated with abortion and delivery, and imperfect convalescence after parturition, with over lactation. The relation of sub-involution to congestion, hypertrophy, and inflammation has been discussed in a previous page. Fissuring and laceration of the cervix uteri during parturition frequently play an important part in originating and keeping up the several forms of inflammation of the neck of the womb. The bot-

tom of the cleft long refuses to heal, and thus keeps up a constant irritation, which indurates and inflames the surrounding parts. Too frequent indulgence in sexual intercourse, or coitus at unseasonable times, are well recognized as potent causes of these affections. As before remarked, the first attempts at intercourse after marriage in some sensitive women are sufficient to light up a sharp attack of endometritis, which, as it subsides, remains as a chronic cervical catarrh for months, or perhaps years, after its inception. It has been remarked that women with whom attempts at sexual intercourse are frequent but imperfectly performed, or who live habitually in sterile marriage, are very frequently sufferers from uterine congestion and inflammation. Habitual masturbation will likewise produce the same results, and the womb is often greatly increased in size from this cause. At the climacteric period of life, when menstruation is becoming irregular, the uterus is sometimes so considerably enlarged as to favor the suspicion that fibroid tumor exists, and the diagnosis between the temporary engorgement and fibroid growth is most difficult. The later subsidence of the swelling, however, eventually clears up the doubt.

The presence of organic disease in the uterine walls is also a direct incentive to uterine congestion. Fibroid tumors, polypi, and cancer cause a larger determination of blood towards the womb, and local irritation there. This is especially the case at the menstrual periods, and hence the proclivity to effusion and hemorrhage then. Congestion and inflammation of the ovaries provoke hyperæmia in the uterus, and just as the initial physiological act of menstruation is commenced in the ovary, and thence is propagated to the uterus under normal conditions, so certain marked changes taking place in the ovaries which simulate the phenomena of menstruation, lead ultimately to congestion of the uterus, which may terminate either in enlargement of the organ, or in hemorrhage, or in both. In prolapsus uteri retroflexion, and anteflexion, the flow of blood is not only likely to be impeded in its passage through the womb, but the local irritation to which the organ may be subjected on account of its displacement or distortion, favors a constant plethora of its vessels, and thus entails all the symptoms and effects of uterine congestion. To the above causes may be added the effect of specific venereal poisons. Chronic inflammation of the uterine cavity and catarrh have seemed to owe their origin in some cases to coitus with a male imperfectly, though apparently cured of old gonorrhœa. Lastly, over meddlesome treatment with speculum, sound, and the various instruments and pessaries employed in uterine ailments, must be enumerated among the causes.

Symptoms and Progress.—An attack of acute metritis is commonly ushered in by a rigor followed by increased rapidity of the pulse, flushed countenance, and hot skin. The patient complains of acute pain and tenderness in the hypogastrium. The pain extends backwards to the loins, and shoots into each ovarian region and down the thighs. There is an abiding sense of weight and bearing-down, and the desire to pass water is almost constant, while micturition is often extremely painful. The intestinal mucous membrane sympathizes also in the disturbance, and often there is violent tenesmus with a catarrhal or dysenteric affection of the rectum. The catamenia, if present at the time, are probably suddenly suppressed, and the vagina is found on examination to be hot and dry. The uterine secretion, however, varies, and sometimes the discharge is hemorrhagic; at other times it is muco-purulent mixed with blood, and so irritating in its quality that it scalds the pudenda and adjacent parts. The uterus is commonly so painfully sensitive to touch, that a satisfactory internal examination is scarcely possible. It may, however, generally be determined that the uterus is the centre of the morbific action. The fundus is tender to external pressure, but ordinarily it is not so far increased in size as to be distinctly felt in the hypogastrium, unless it has previously been the seat of hypertrophy or fibroid tumor, or the attack has supervened on recent delivery. After abortion and delivery there is occasionally such rapid increase in size, by effusion into its meshes, that in the course of a few hours it can be felt as a considerable tumor above the pubes, and subsidence is sometimes almost equally rapid when action has ceased. Where the tissue of the uterus is not so lax, the augmentation in bulk is less notable. When vaginal examination is practicable the cervix is found turgid and painful to touch; it is somewhat below its natural position in the pelvis, and the arteries entering its lateral borders pulsate with undue prominence. The vagina is dry and hot, or bathed with irritant muco-pus. Frequently the sympathetic fever is accompanied by frontal headache, nausea, and vomiting, and in susceptible subjects, by a variety of hysterical symptoms. The hysterical symptoms are sometimes so prominent during an attack of acute metritus, that, unless great care be taken, the local condition may be overlooked. Making due allowance for the difference in constitution in individual patients, the severity of the symptoms will be in pro-

portion to the intensity of the local inflammation and the extent of the tissue involved. The most severe and perilous cases occur in connection with the puerperal state, and in the worst forms the marked phenomena are not limited to the symptoms detailed above. As the malady progresses the peritoneum becomes involved and there is more general pain and tenderness. Eventually tympanites appears accompanied by increased restlessness, delirium, and other indications of cerebral derangement. The tongue becomes loaded, dry and brown; the pulse becomes feeble, rapid, and thready, and the skin grows cold and clammy. Eventually the prostration may amount to collapse and end in death. In some of those examples where inflammation either has originated in a recent wound, or where there has been a sudden and violent suppression of the catamenia, there is good reason to believe that many of the symptoms are due to blood-poisoning, as in puerperal cases, and that the metritis is only part of a constitutional ailment. It is worthy of remark, that in some of those cases which have a fatal termination, very little hypogastric tenderness is complained of throughout the attack, and hence the difficulty of diagnosis is increased. In a proportion of cases the disease is accompanied with symptoms much less violent than the above. There may be local pain, irritating and excoriating discharge, painful micturition, and some febrile excitement, but the active symptoms gradually subside, and the patient recovers, or indications of chronic metritis eventually establish themselves.

The symptoms of congestion and chronic inflammation of the womb are extremely variable, whether we consider them in reference to their constancy, degree of intensity, or the locality in which they present themselves. As in other forms of chronic uterine ailment, there is often no sort of relation between the discomfort produced or the impairment of function which takes place, and the extent of local injury. It is a matter of common observation that a very slight deviation in uterine health may give rise to very troublesome and obstinate symptoms, while on the other hand considerable organic changes of structure may take place, nay, malignant disease of the cervix may make considerable progress, without giving rise to any grave symptoms. The same inconstancy of symptoms, noticeable during the progress of pregnancy, is equally observable in connection with chronic uterine inflammation—at one time there is marked pain and uneasiness referable to the uterus itself, or to the organs in its vicinity, and to these may be added derangements of function and pains in other and distant parts. At other times there is an absence of all these concomitants, and it is only the presence of some single sign, such as persistent discharge or sterility, which attracts the attention of the patient. During the progress of any particular case indications of internal disorder may at one time be very prominent, at another quite in abeyance without any very marked alteration in the local condition to account for the change.

Commonly the patient experiences a sense of weight and discomfort in the pelvis, pain in the ovarian regions and back, probably shooting round the abdomen and down the lower extremities. The pain is ordinarily aggravated by exercise and relieved by rest in the recumbent posture. Dr. Churchill has noticed in several cases a peculiar pain in three different localities, viz., "in the symphysis pubis, at the point of the coccyx, and along the sciatic nerve to the knee, which he should hardly have attributed to the congestion and erosion had it not been removed by curing them." With bearing down there is probably associated a feeling of pressure on the rectum and bladder, and a frequent desire to evacuate these organs is followed by an imperfect sense of relief or aggravation of the previous irritation. The rectum and bladder are most frequently involved when some increase in size or displacement of the uterus has taken place, and the symptoms are no doubt partly due to the effects of physical pressure. In the more occasional cases where such disturbance is present without decided enlargement or displacement of the uterus, it is probably reflected irritation—more rarely there may be actual extension of inflammation to the bladder or rectum. Constipation and painful defecation are frequently observed, and the feces are often coated with muco-pus as the result of the irritation transmitted to the intestinal mucous membrane. Hæmorrhoids are not infrequent, and are apt to become more troublesome at the catamenial periods. Occasionally diarrhœa is present instead of constipation, and small quantities of mucus are repeatedly discharged mixed with but small quantities of feces. The irritability of the bladder is sometimes most distressing—day and night being alike disturbed by the desire to void the urine. The urine itself is often high-colored and loaded with urates; occasionally it contains quantities of mucus and pus-cells. The pain in passing water and the frequent micturition may, indeed, readily mislead the practitioner into the belief that his patient is suffering from some primary disorder of the urinary organs instead of the uterus. The catamenia are either too profuse and too frequent, or too sparing and attended with

pain, or perhaps suppressed altogether. All the symptoms of the intermenstrual interval are apt to be more intense with the occurrence of the menstrual period. Often there is severe dysmenorrhœa with paroxysms of uterine colic, and in a certain proportion of cases the cessation of the menstrual flow is followed for several days by such acute and persistent pain as to lead to the suspicion of acute inflammatory action going on. The discharge is often mixed with clots which give pain during their retention in, and expulsion from, the uterus, and in the membranous form of dysmenorrhœa, shreds or more complete casts of the uterine cavity are extruded. With some patients, again, the return of the catamenia brings notable relief, and the days of their continuance are the only ones in which there is comparative comfort.

The exercise of the generative functions is often rendered so painful as to lead to its discontinuance, while in long-standing cases where all tenderness may have passed, patients sometimes complain that the sensibility of the nerves is obtunded and all desire extinguished. Sterility is a frequent, though not an invariable, consequence, and if conception does occur in such condition there is proclivity to abortion. In the intermenstrual intervals the vaginal discharges vary. In a small proportion of cases there is a diminished secretion of the ordinary mucus, and the genital canals are drier than natural. More constantly there is over-abundant discharge either of clear mucus, or mucus mixed with pus and occasionally with blood. These ingredients in varying combinations produce clear and transparent, white or yellow, brown or reddish discharges, in accordance with the degree and stage of the inflammatory process. When vascular granulations are present, coitus or mere locomotion may at any time be followed by a scanty or more profuse flow of blood, and in some cases even when the patient is at rest, there is a constant tendency to dribbling hemorrhage during the whole menstrual interval.

When leucorrhœal discharge is thick and gelatinous it is characteristic of chronic inflammation of the cervical canal, and it is the product of hypersecretion from the gland follicles there. Not unfrequently in endometritis, there will be no uterine discharge for a time, and then, after considerable pain, there will be a gush of muco-purulent or sanguino-purulent fluid which has been pent up in the inflamed uterine cavity.

All these discharges are sometimes so acrid as to excoriate the external parts, and obstinate pruritus vulvæ is often complained of, produced by the irritating quality of the secretions from the parts above.

The constitutional symptoms associated with chronic metritis are a deterioration of general health, loss of appetite, torpidity of the bowels, spanæmia, lassitude, and mental depression. In more aggravated cases, or in patients of nervous constitution, there are often indications of dyspepsia, nausea, sickness, and biliary derangement; headaches, neuralgia, sympathetic pains and swelling in the mammæ, pains in the loins; and to these may be added the developments of hysteria in its protean forms, which, if comparatively in abeyance during the interval, become aggravated at each catamenial period. Sir James Simpson and Dr. Todd, both pointed out the constant association of infra-mammary pain with uterine and ovarian derangement, and this reflected infra-mammary pain is more frequently under the left than under the right breast.

There is rarely much febrile disturbance except in connection with the pain at the catamenial periods, when the patient may suffer from congestive dysmenorrhœa. Then the pulse increases in frequency, the countenance flushes, and shivering may alternate with febrile symptoms. At these times sympathetic nausea and vomiting often render the condition of the patient most distressing, hysterical symptoms are apt to be prominent, and headache and lassitude remain after the more urgent symptoms have passed.

Now and then the general symptoms assimilate themselves very closely to the signs of pregnancy. There is darkening of the areolæ and pains in the mammæ, nausea, vomiting and other sympathetic phenomena. If the uterus be enlarged at the same time and menstruation deranged, an error in diagnosis is readily committed. Dr. Tilt regards the signs of pregnancy, without menstruation being suspended, in comparatively young women, as *prima facie* evidence of the existence of internal metritis. Many of the general symptoms above mentioned may be secondary in their character, and have been provoked by the inability of the patient, suffering from a local ailment, to take exercise and obey such natural laws as are essential to the maintenance of health, but in a large class of cases in which chronic inflammation has arisen, so to speak, spontaneously, and has not been consecutive of parturition or abortion, there has been, from the outset, some departure from a sound constitutional condition. The local affection is the consequence and effect of the general derangement, and attention to the general health is of the first importance in the treatment.

The functional signs being so variable and uncertain, physical examination be-

comes necessary, when an accurate diagnosis must be made, and this may be had recourse to with the less hesitation when the patient is married, and the symptoms are grave enough to demand it. Local examination is conducted with the fingers, aided, when necessary, by the speculum vaginæ and the uterine sound, and the exploration may be both by the vagina and rectum. In certain cases only will the uterus be so much enlarged from the results of chronic hyperæmia or metritis, apart from the presence of some other form of uterine tumor, as to permit the fundus to be felt by external examination of the abdominal walls. When the outline of the uterus, cannot be made out, there may be acute tenderness on pressure over the fundus, and this tenderness, even when unattended by discharge, Dr. Routh states, is indicative of what he terms "fundal endometritis." Where, however, congestion and slow inflammatory action have been very persistent, or where attacks have been often repeated, or have supervened on sub-involution, the enlarged womb may perhaps be felt above the symphysis pubis,—particularly when the patient is thin, and the absence of adipose tissue in the abdomen facilitates the examination. Internal digital examination rarely fails to detect some increment in the bulk of the uterus whenever the parenchymatous structure has been long affected. The organ then feels heavy,—its structure more turgid and denser than natural,—and often the womb sinks below its normal level in the pelvis. In one form the organ is movable, its outer surface smooth, and its shape is altered somewhat by the swelling having rendered less distinct the demarcation between the body and the cervix. In other forms, some irregular nodulation or bulging in the body or fundus, is felt either by the vagina or rectum, or those partial hypertrophies of the cervix previously described are detected by the sense of touch. Where action is still in progress, there will probably be undue sensibility to touch and increased heat and dryness of the vagina. If there be erosion or ulceration, some indication of its presence will be afforded by the loss of perfect smoothness around the os uteri, and by the perception of either a velvety surface characteristic of abrasion of the rougher and more irregular conditions produced by the deeper forms of granular inflammation and ulceration. The os uteri may be widely patent or narrowed and distorted in shape by the tumefaction and lobulation of the labia. Dr. H. Bennet lays great stress on the patency of the external os uteri as an indication of the presence of inflammation of the cervical canal. There are, nevertheless, constantly recurring examples in which the os uteri is widely dilated from the effects of some previous delivery or abortion, and where no inflammatory changes are in progress. Where flexion or version are present as complications of metritis, the cervix may be displaced anteriorly or posteriorly in the pelvis, or laterally to either side. The alterations on the surfaces of the cervix, detected by the finger, may be further verified by the use of the speculum, and by means of this instrument the various changes in the color of the mucous membrane, the source and character of the discharges, the appearances of partial hypertrophies of the labia uteri, and of ulcerated surfaces, may be ascertained. Sometimes, indeed, the sense of sight, aided by the speculum, may discover abrasions and superficial ulcerations, which practised touch fails to detect; and it is well known that soft mucous polypi of small size sometimes associated with abrasions, and attended by hemorrhage and leucorrhœa, often elude the sense of touch but are readily recognized on visual examination.

By the uterine sound the practitioner is further enabled to ascertain when hypertrophy has taken place either in the cervix or body; the thickness of the uterine walls; the direction and length of the uterine cavity; the mobility of the uterus as indicating whether it has become fixed by inflammatory adhesions or not; the degree of sensibility, or the reverse, in the mucous membrane lining the uterine cavity; the presence of stricture in the cervical canal or the opposite condition of undue patency. The elongation of the uterine cavity has been regarded as affording evidence that the body of the uterus is the seat of hypertrophy or inflammation, but other affections of the uterus are also attended by increase of measurement of the cavity. This is the case when the cervix is elongated, when there is sub-involution, and in some of the forms of fibroid tumor. Not infrequently also the fundus uteri is pulled upwards, and its cavity extended by the growth of an adherent ovarian tumor.

In endometritis the uterine cavity has an increased sensibility. The passage of the sound produces great pain, and is often followed by bleeding and persistent uneasiness for some time afterwards. In many women who are not the subjects of uterine inflammation, the passage of the sound gives pain, particularly when the fundus is reached, but when endometritis is present the suffering produced is quite beyond the measure of what occurs under like circumstances in the healthy womb, although the sound may have been passed with great facility on account of the dilatation of the os uteri internum.

In reference to the employment of these instruments, it may be remarked that in

most cases they are useful aids rather than essentials to correct diagnosis, and that if the sense of touch be carefully cultivated, they will, in multiple instances, but confirm what has already been made out by digital examination. The use of the speculum for diagnosis in *all* cases of chronic inflammation or ulceration of the cervix is manifestly superfluous, and, in unmarried women, is commonly both unnecessary and injurious. Again, the use of the sound should be carefully avoided whenever increased sensibility seems to indicate inflammatory action still in progress, as by its injudicious employment a further impetus may be given to inflammatory progress.

Diagnosis.—An attack of acute metritis has some symptoms in common with abdominal peritonitis, with pelvic peritonitis and cellulitis, and with ovaritis. In abdominal peritonitis the pain and tenderness are more general, while, with the localization of the suffering in metritis, there are probably some concurrent symptoms in the history of the attack pointing to the uterus as the organ attacked. In acute ovarian inflammation, the pain is in the iliac regions of the pelvis rather than in its centre, and if a vaginal examination be made, the affected ovary will probably be found swollen and tender, lying behind the broad uterine ligament or in the peritoneal *cul-de-sac*. When cellular inflammation or pelvic peritonitis is in progress, lymphy exudation speedily fixes the uterus so as to interfere with its mobility, but inasmuch as inflammation, beginning in the uterus or ovaries, often quickly extends itself to the cellular tissue and peritoneum in its vicinity, it is not easy to determine, by examination, where the action first began. The clearing up of this point is of the less consequence inasmuch as the treatment is the same in both cases. Acute cystitis may be distinguished from metritis by noticing that the urgent symptoms are centred in the bladder, while on examination, unless the attack is an extension of metritis, the uterus is found to be little affected.

Concerning the diagnosis of the results of chronic congestion and inflammation, it may be stated that, perhaps, the most frequent difficulty arises in estimating the distinctions between some of the forms of hypertrophy and ulceration produced by inflammation, and incipient cancer of the uterus. In the later stages of malignant disease the rough and irregular excavation of the ulcerated surface bounded by the sharp hardened edges, the characteristic odor of the discharges, and above all the fixing of the uterus by surrounding infiltration, render the nature of the affection but too obvious. But in the earlier stages of cancer, when the uterus is still perfectly movable, and only slight changes have occurred in the tissues of the cervix, the determination of its true character is by no means easy, and it must be in the recollection of all practitioners of experience that cases occasionally present themselves concerning which they have entertained the gravest suspicions, and which, nevertheless, have yielded to appropriate treatment. Whenever uncertainty exists it is well to give the patient the benefit of the doubt, so that the necessary methods of cure for the simpler affection, if such it turn out to be, are not omitted. It may facilitate the formation of a correct opinion to bear in mind the distinction pointed out by Dr. Bennet between simple hypertrophy of the cervix and early cancer. In the former the fissures radiate from the os uteri as a centre, which they do not do in carcinoma; and further, that there is little variation except for the worse in the malignant disease, while in the more benign affection often marked amelioration is observed for a time as the result of treatment, even in cases where recovery is slow or cure imperfect. Dr. Spiegelberg has remarked that the use of a sponge tent leaves the tissue hard and tense in scirrhous cancer, while it softens it in the benign affection. It is necessary to recollect that during the progress of metritis, if complicated with peritonitis or cellulitis, the uterus may become fixed to surrounding parts, and that the imperfect mobility of the uterus does not therefore always imply the presence of malignant disease. The enlargements of the body of the uterus from pregnancy and fibroid tumor are to be distinguished from hypertrophies the result of congestion and inflammation, by noting the associated signs of pregnancy in the first case, and the absence of inflammatory history in the last. When there is no distinct history of precursory inflammation, the diagnosis of uterine enlargement resulting from metritic changes, and fibroid tumor in the walls of the womb, is often impossible during life, and it is probable that in most instances of reputed cure or diminution in size of fibroids by Kreuznach waters and other absorbent remedies, the swelling has been due in part or entirely to hyperæmia or to unorganized adventitious deposits, capable of absorption.

The local hypertrophies which project from the posterior or anterior walls, may be distinguished from retroversion and retroflexion, from anteversion and anteflexion, by finding that the swelling can be made to disappear on pressure upwards with the finger, and if further evidence is required (as, for example, when the uterus is fixed), by ascertaining the direction of the uterine cavity with the sound.

The character of tumors which are sometimes formed in the vagina either by

regular or nodular hypertrophies of the cervix, may be determined by the position of the os uteri, and by the length of the uterine cavity. In those rarer forms of tumor in which the structure consists largely of cystic growth, the distended cysts may be felt and seen scattered over the surface or imbedded in the mass, with intermediate distended veins, and the presence of the cysts in *prima facie* evidence against its malignant character.

The forms of inflammatory ulceration may be distinguished from the "*corroding ulcer*" of Sir Charles Clarke by the more rapid extension of the corroding ulcer, the alarming hemorrhages, fetid discharges, and indications of malignant cachexia. From syphilitic ulceration of the cervix there seems no way of distinguishing the non-specific form, except by the general history in conjunction with concurrent symptoms.

When the presence of erosion or ulceration is discovered, it is important to ascertain not only its character and extent, but also to recollect that it often forms part of a deep-seated, and perhaps more intractable, uterine or ovarian ailment. It is essential, therefore, to proper diagnosis, not to overlook any enlargement or displacement with which the ulceration may be associated, or perchance some affection of the ovaries upon which its presence mainly depends.

To enter minutely into the differential diagnosis between chronic metritis with affections of the bladder, rectum, and other neighboring organs, is beyond the limits of the present paper.

Prognosis and Terminations.—An attack of acute metritis either in the puerperal or unimpregnated condition is always formidable, and in the severer cases the prognosis is a grave one, inasmuch as if the patient escapes the immediate perils to life, the after results of exudation and adhesion often lead to very serious inconveniences of a chronic character. In the chronic form the prognosis is usually favorable, and cure under a suitable plan of treatment may in most cases be predicted.

Recovery from many of the results of uterine congestion and inflammation is, however, commonly tedious, and the patience of both medical practitioner and patient is often severely tried. From the anatomical position of the uterus, repose in the horizontal posture becomes almost an essential for cure, and as patients frequently object to the necessary restrictions, the progress of the affection is often unduly prolonged. On the other hand, patients willing to submit to the needful discipline for the uterine ailment, often suffer in general health from the lack of exercise and exposure to fresh air, and thus the constitutional cause out of which the local ailments may have sprung originally, is intensified. A just balance, nevertheless, may in most cases be struck between the necessities of each case, and restoration be anticipated.

In some obstinate cases the pathological condition may remain much in the same state for a prolonged period, growing neither better nor worse, even with careful treatment. The fear is that by persistence, induration and hypertrophy with their several complications, which promised at first to be only temporary, should become permanent and entail all the inconvenience of such conditions for a long future, or until the "change of life," lessens the vitality of the generative organs. It is probable also that the development of fibroid uterine tumors take their initiative in a perversion of growth arising out of persistent chronic inflammatory deposits; and there is some reason for believing that continued irritation and enlargement of the ovaries, the thickening of their coverings and the adhesions to surrounding parts so often associated with uterine inflammation, may so interfere with the performance of ovulation as to prove an active incentive to the development to cystic ovarian disease. There would seem to be little tendency for chronic hypertrophy and ulceration to degenerate into cancerous disease, but these benign alterations in structure may, in those predisposed, form a nidus for the development of malignant growth, and, by the irritation they produce in the womb, be indirectly conducive to it. Chronic enlargement of the uterus, whatever may be its cause, is a fertile source of displacement. Whenever the two conditions are found in conjunction—it matters not which has been the primary affection—the recovery is always more difficult and protracted.

Stricture of the cervical canal may likewise result from the healing of the several forms of ulceration of the os uteri, and from the effects of escharotics employed in their treatment. In this way obstructive mechanical dysmenorrhœa may be provoked after the inflammatory attack has been subdued, and the labia uteri may become so rigid as to oppose serious resistance to dilatation in a subsequent labor. Although conception may take place while some of the forms of chronic uterine inflammation are present, sterility is more frequently observed to be the rule, until the womb has returned to its normal condition again.

Treatment.—The treatment of inflammation of the womb is to be conducted on the same principles as those applicable to inflammation of other internal organs, special regard being given to its position in the economy and the peculiarity of its

functions. In the acute form all examinations should be made as seldom and with as much gentleness as possible. No instruments should be used in diagnosis, and no irritating or astringent local applications should be employed in the treatment. Venesection may be practised in some cases, where the patient is robust enough to bear it and the attack is urgent enough to call for it. Local depletion is desirable in nearly all cases, and as the probable tenderness of the genital canals precludes the introduction of a speculum, leeches may be applied either to the hypogastrium or round the anus as more directly abstracting blood from the pelvic bloodvessels. The earlier the bleeding is had recourse to, the more obvious generally is the result, and the more perfect the relief. The bleeding may be repeated according to circumstances. Opium will be required in some form in frequently repeated doses, and it may be conveniently combined with tartarized antimony to lessen the force of the circulation and promote diaphoresis in the earlier stages; and with calomel and perchloride of mercury in the latter periods, to promote absorption of exudation. Dr. West speaks highly of the extract of belladonna as an anodyne in these cases, and he prescribes it in doses of one-sixth to one-quarter of a grain every four hours, increasing the quantity if necessary. Belladonna may also be usefully employed externally during the decline of acute metritis. When the need for poultices and fomentations is past, equal parts of ungt. belladonn. and ungt. hydrarg. may be spread over the surface of the abdomen and covered with flannel. These remedies may be supplemented by salines such as the acetate of ammonia or citrate of potash, when there is much febrile disturbance, and more especially when the urine is scanty and loaded with lithates. If the patient is able to leave her bed, a warm hip-bath may be permitted, and the continuous use of hot linseed poultices with laudanum or tincture of belladonna over the surface rarely fails to afford relief to the severe pain. If required, counter-irritation may be produced by sinapism or turpentine over the abdomen, but blistering by cantharides should be avoided, lest it aggravate dysuria. If the bladder is much disturbed, its irritability may be soothed by drinking freely of demulcent fluids, such as barley-water and linseed-tea, and if there is excoriation of the vagina from irritating discharges these fluids may be injected. It is well not to disturb the patient by aperients at the first outset of the attack, but no long time should be allowed to elapse without relieving the bowels by a gentle laxative or an emollient enema. If the bowels are irritable and diarrhœa occurs, Dover's powder may be given with hydrarg. c. cretâ, or an opiate enema or suppository may be prescribed for the double purpose of allaying irritation of the bowels and quelling the paroxysms of uterine pain.

The patient should maintain absolutely the recumbent posture, and have the pelvis somewhat elevated, by way of obviating as much as possible the effects of gravity. The diet should be simple and unstimulating, no wine or spirits being permitted until the acute symptoms have subsided, unless there be manifest failure of power and stimulants become essential. The treatment of the after results is essentially the same as that applicable to the various forms of chronic inflammation, into which the more acute form is apt to merge when imperfectly cured, and great care should be taken when the patient is apparently well to guard against the danger of relapse for a considerable period. More especially ought there to be absolute repose at the menstrual periods for two or three months after.

The treatment of uterine congestion and of chronic metritis must necessarily be modified by the form the malady assumes, by its locality, by its duration, by the extent and gravity of the symptoms with which they are accompanied, and by a diversity of other matters requiring careful consideration.

Not the least important is the prophylactic or preventive treatment. In all cases where either the antecedent history, or where conditions are known to exist which may favor internal congestion or inflammation, special precautions should be taken. When it has been ascertained, for instance, that sub-involution after delivery is present; when there is fibroid tumor or displacement of the uterus; much rest in the recumbent posture should be enjoined at all times, but especially at the catamenial periods. The same precaution should be observed after abortion; when ovarian irritation or over-frequent menstruation is present; and in cases of habitual dysmenorrhœa. The importance of rest, within such limits as the general health will bear, so as to obviate the effects of gravity and locomotion, can scarcely be over-estimated, and it must be within the experience of most hospital physicians how constantly all measures of treatment without rest fail to prevent and cure uterine congestion and inflammation, and how frequently repose with but little other treatment suffices for the recovery of the patient.

As in a considerable number of cases, congestion and chronic metritis take their origin in faults in general health, or, being incidentally produced by other causes, are prolonged and intensified by constitutional disturbance, great care should be taken from the outset to trace

out any existing systemic derangements or any disturbance in other and distant organs which may possibly be overlooked in the prominence of the uterine symptoms. The late Dr. Edward Rigby especially insisted upon the dependence of chronic uterine ailments on constitutional causes, and urged the importance of rectifying faults in the general health as a preliminary to all other treatment. More particularly he dwelt on the necessity of carefully regulating the functions of the chylopoietic viscera, as obstructions in the portal circulation greatly favor congestion of the pelvic bloodvessels. As a first and most important preliminary, therefore, the condition of the general health should be carefully inquired into, and its faults corrected if need be. If there be evidence of plethora on the one hand, or anæmia and asthenia on the other, these should be combated by appropriate means. Injurious or enfeebling habits of life should be rectified,—any depressing influences, such as over-lactation, habitual discharges, loss of blood from hæmorrhoids, sources of mental anxiety, &c., should be removed if possible. Good food, warm but light clothing, fresh air, with exercise appropriate to each case; and mineral acids, with iron, or vegetable tonics, should be prescribed as required; the bowels should be carefully regulated, and if the liver is habitually sluggish, some suitable alterative may be prescribed from time to time. There should be abstinence from marital intercourse; violent or excessive exercise, such as long walks or dancing, should be prohibited, and it may be necessary to discontinue both riding on horseback and carriage driving, even when moderate walking is permissible. There should be no undue pressure upon the pelvic organs by the abdominal viscera, and faults in dress conducing to this should be corrected. It may be desirable indeed to raise up the abdominal organs by a bandage when too much laden with fat, or when the abdominal walls are much relaxed. When any particular diathesis is present it commonly gives a type to the local ailment, even if not directly concerned in its production. The painful affection described by Gooch as "irritable uterus," which is closely akin to an inflammatory condition, is often distinctly associated with a constitutional tendency to rheumatism or neuralgia, and is only to be relieved by prescribing for the prevailing diathesis. Other forms of chronic uterine inflammation seem to depend on a gouty constitution, and require special treatment in accordance with the pathology of that condition. When organic disease exists in the uterus all possible precautions must be taken to lessen the accidental sources of irritation associated with its presence there. Successful treatment further requires the recognition of the inter-dependence of some pathological conditions on others, and the necessity of treating more especially the affection which may be the keystone to the rest. Thus continued endometritis or cervicitis may produce both tumefaction of the uterine walls and erosion or ulceration of the os uteri; then treatment must mainly be directed to cure the disease in the uterine cavity. Mucous polypi, hidden in the cervical cavity, will produce hyperæmia, and persistent hyperæmia of the uterus generally will not only originate and perpetuate enlargement of the uterus, but lead to cervical catarrh with abrasion and ulceration of the cervix. When such is the order of pathological events, it is obvious that mere alterative and astringent applications to the surface inflammation about the os tincæ, will have little curative effect unless measures be taken to remove the exciting cause.

If the uterus is in any way displaced, the necessity of readjusting its position must be kept in view as soon as this is practicable.

The theory promulgated by M. Velpeau, and subsequently resuscitated by Dr. Graily Hewitt, that patients suffering from symptoms of uterine inflammation are almost universally found to be affected with flexion or version of the organ, and that the treatment for displacement is therefore, as a rule, of primary importance in these cases, is not in consonance with general experience. It is important, however, to recognize the fact that displacement may in certain patients, originate and perpetuate uterine inflammation until it is rectified, and that flexion and version may take place as secondary complications of congestion and inflammation, when the fundus has grown heavy, its ligaments relaxed, and the tissues of the womb have become softer than usual. The employment of mechanical appliances, even when these are thought necessary, is certainly counter-indicated when there is any undue tenderness about the uterus and its appendages, and under these circumstances it is best to postpone the rectification of position by mechanical means until pain and sensitiveness have abated. The postural methods for displacement may without fear be recommended, as they necessitate no manipulations of the tender womb. When the sensitiveness has passed, some form of vaginal pessary, suitable to the circumstances—or a pelvic belt—may be employed, and if carefully adapted, the support will then give much relief, even when enlargement proves too obstinate to be removed by the remedial measures prescribed. In habitual prolapsus, the elevation of the uterus and the retention in its

natural position is almost essential to the prevention and cure of the hyperæmia and other morbid results which ensue from the interrupted circulation and exposure to mechanical injury.

The local treatment of congestion, induration, thickening, and hypertrophy of the body and cervix, consists therefore, in the first place, in the enforcement of such rest in the recumbent posture as the constitutional condition will bear. Next, the local abstraction of blood by leeches or scarification is of great value. On the continent, the derivative effects of repeated small bleedings from the arm has been lauded as offering greater advantages in promoting cure than local depletion, but in Great Britain this method is little practised. In this country leeches are commonly applied when deemed necessary either to the hypogastrium, to the anus, or to the cervix uteri. When the capacity of the vagina and the absence of tenderness will permit, leeches are best applied to the cervix by means of a small speculum or leeching-tube, for in this way the most decided results are produced upon the over-distended bloodvessels. When possible, it is best to choose a time for the abstraction of blood midway in the menstrual interval, so as to disturb as little as possible the regular return of the catamenia. Where, however, the flow at the period has been very scanty, attended with much pain, and it is desired to supplement the sparing discharge, the leeches may be employed immediately after. If scarification be preferred, it can be performed through a speculum by an appropriate lancet with a sufficiently long handle. To procure a free bleeding, the scarifications must be numerous; and punctures an eighth of an inch deep into the uterine tissue produce a more effectual flow than mere surface scarification. Neither scarification nor puncture as a rule give much pain to the patient, and when leeches are not available they offer a ready substitute, but often seem less effective. The quantity of blood to be abstracted must necessarily vary with the result to be attained and the strength of the patient. With symptoms very active, it may be necessary to apply from three to six leeches and repeat them after an interval of three or four days; in other circumstances a small depletion once in the menstrual interval and repeated a month later may be all that is required. The flow of blood is favored by the use of fomentations and warm hip-baths. Blood may also be abstracted by cupping over the sacrum. The results to be attained by blood-letting may be further advanced by counter-irritation. Dry cups and vesicants may be used over the sacrum, or the skin may be irritated by croton oil and tartarized antimony. If the surface of the abdomen is selected for counter-irritation it is well to avoid the use of cantharides lest it provoke strangury, but strong tincture of iodine or successive sinapisms may be advantageously employed in this locality. The systematic use of a warm hip-bath is a further valuable adjunct to other treatment, and when medicated either by some sedative or absorbent, possesses additional advantages. The iodo-bromated waters of Kreuznach, Hale, Durkheim, and Krankenheil, have a great reputation for reducing adventitious enlargements of the uterus in chronic cases, and Woodhall Spa in this country is reported to have similar properties. An artificial Kreuznach bath may be extemporized by adding half a pound of Kreuznach salt and two pounds of common salt to three gallons of warm water in a hip-bath. The patient remains in this from fifteen to thirty minutes, and it may be used every night or every second night. At Kreuznach, it is customary to apply the concentrated water or "mother lye" in the form of compresses across the abdomen, and advantages may also be obtained by the frequent use of a continuous tepid douche, to the water of which is added either a proportion of Kreuznach water, or Kreuznach salt, or, when these cannot be obtained, small quantities of tincture of iodine or iodide of potassium. If there be much local pain, it may be desirable to recommend the injection of warm poppy decoction into the vagina, or a lotion composed of warm Goulard water and laudanum, in the proportion of a pint of the former to one or two drachms of the latter. The medicated pessary also offers another mode of applying remedies to the uterus, and in this form belladonna, atropine, morphia, and other sedatives may be introduced into the vagina. Bromide of potassium, iodide of lead, and other remedies may be used as absorbents in the form of pessary, either alone or in combination with sedatives. It must be recollected, however, that double the quantity of morphia, or other sedative administered by the rectum, requires to be used by the vagina, as the genital canal has a feebler absorbent power. Formulæ for the different varieties of medicated pessary, will be found in the supplement to Squire's Companion to the British Pharmacopœia. The internal remedies found useful in reducing the size of the congested and inflamed uterus are the various salts of bromine and iodine, and alterative doses of mercurial preparations. Dr. Oldham, some years ago, recommended small doses of perchloride of mercury for reducing the enlargement of a uterus produced by chronic inflammation, and there is perhaps no remedy more potent in suitable cases. Given with bark and other tonics, it may be ad-

ministered for prolonged periods, and commonly without constitutional disturbance or ptyalism.

In protracted cases of inflammatory thickening of the cervix, advantage may be obtained by repeatedly painting the surface, through a speculum, with tincture of iodine the strength of the Edin. Pharm. on the same principle as iodine is applied to enlarged glands and tonsils; or a pledget of iodized cotton may be applied, as recommended by Dr. Greenhalgh. The iodine seems to have the double effect of an absorbent and counter-irritant when so applied. Repeated applications to the cervix of a tampon soaked in a mixture of one part of tincture of iodine and two of glycerine, and subsequently covered over with cotton-wool, have proved useful in these conditions. Glycerine alone even seems to act as a local hydragogue and to promote subsidence of the swollen tissues. Should more energetic measures be thought necessary, internal counter-irritation may be produced by rubbing solid nitrate of silver over the cervix uteri until a breach of surface is made over the mucous membrane, or blisters may be produced by carefully painting vesicating collodion or *acetum cantharidis* on the uterine neck, through a speculum, as recommended by M. Aran. A flow of serum is the result, which is said to act as a useful derivative. Great caution is required in following out this practice. When such hypertrophy of the cervix exists that it simulates prolapsus, and resisting all treatment seriously interferes with the comfort of the patient, it has been proposed to remove the portion of the cervix below the reflexion of the vagina by amputation. This operation may be successfully performed with the *écraseur* — great care being taken so to limit the part removed that the peritoneum behind is not endangered; or the part may be removed as recommended by Dr. Marion Sims by first dissecting back the mucous membrane of the cervix, removing the hypertrophied structures, and afterwards bringing the dissected parts together like the flaps of an amputated limb.

In the treatment of chronic inflammation of the mucous lining of the uterus the same general rules must be observed as those laid down in the last section, and this more especially in view of the fact previously pointed out that inflammation of the mucous membrane rarely persists for any length of time without extending to the middle coats and producing characteristic changes there as well as in the ovaries. In both the *membranous* and *catarrhal* varieties much rest is essential, and special precautions should be observed at the catamenial periods. Sexual intercourse, if not entirely prohibited, should be at distant intervals. Where there is evident turgescence of the uterine tissue agreeable to the sense of touch, or a congested appearance of the mucous membrane of the cervix, as seen through a speculum, and particularly if the parts are tender to pressure, the application of leeches is indicated between the periods. A course of perchloride of mercury with tincture of bark, followed by bromide or iodide of potassium, or both combined when the patient's strength will permit, often renders signal service. Unfortunately these remedies are not well borne when there is anæmia and much general feebleness. In these cases the iodide of potassium may speedily produce the ordinary symptoms of iodism, and although the bromide may occasionally be taken for months without impairing nutrition, yet women often complain, while under its influence, of irritation produced on the skin, and the constant recurrence of crops of acne. This may oblige its use to be relinquished.

The late Dr. Dewees of Philadelphia recommended the administration of the ammoniated tincture of guaiacum, in the membranous form of dysmenorrhœa, and stated that it had proved remarkably efficacious as a method of relief and cure in his hands. It is probably best adapted to those cases of dysmenorrhœa which are associated with a rheumatic diathesis, but as an alterative it has proved useful in other forms of chronic uterine inflammation, promoting activity in the various secretory organs, and acting as a laxative on the bowels. The pain experienced at the monthly periods may be palliated by the use of warm hip-baths and fomentations in those cases where the loss of blood is not excessive, or likely to be unduly increased by such measures. Further relief may be afforded by opium or morphia administered either by the mouth, rectum, or by hypodermic injection. As the pain is frequently more or less spasmodic in character, sulphuric ether or valerian may be combined with laudanum or compound tincture of camphor. If the use of opium or morphia is precluded on account of the sickness or other discomfort it produces, it may be replaced by suitable doses of iodoform, Indian hemp, henbane, conium, or belladonna. A useful formula for relieving suffering at the menstrual periods in these cases without having recourse to opium, consists of a third of a grain of extract of belladonna, three grains of camphor, and enough extract of henbane to make a pill. This may be given every three or four hours. *Apiol*, a volatile oil from the parsley tribe, is given in France for the same purpose. The dose is inclosed in a gelatine capsule by way of avoiding its pungent taste, and in the experience of the

writer it has often given notable relief, but whether it possesses any other property than that of a warm diffusible stimulant is not well determined. As a radical method of cure in cases of membranous inflammation, it has been proposed to cauterize the interior of the uterus by nitrate of silver or other caustic. There seems no evidence as yet, however, of the utility of this practice, and when it is recollected that this form of uterine inflammation is commonly associated with, perhaps essentially dependent on, ovarian irritation, local applications to the interior of the uterus do not afford much promise of ultimate benefit, and it is best to rely mainly on the general remedial measures employed in chronic congestion and inflammation of the uterus.

In treating cases of chronic uterine catarrh, or, in other words the catarrhal variety of chronic endometritis, it is necessary to recognize two forms which require different methods of management. Thus, wherever, in conjunction with habitual hyper-secretion from the uterine cavity, there is pain and tenderness, more or less tumefaction or hypertrophy of the deeper structures, or a congested appearance of the cervical mucous membrane, and possibly undue throbbing of the uterine arteries, with occasional mixture of blood in the discharges, the most appropriate treatment is absolute rest, leeching, the use of local sedatives and soothing injections, and the administration of such remedies as were recommended for inflammation of the proper substance of the uterus. Under these circumstances all local treatment by strong astringents or caustic applications is contra-indicated. It is commonly found, indeed, that the sudden checking of secretion provokes more suffering, and probably produces more profound lesion.

When the symptoms indicative of more active mischief are absent, or have been subdued, the necessary measures for improving the condition of the mucous membrane, and thus arresting the undue secretion from its surface, may with propriety be undertaken. In this phase uterine catarrh is very generally admitted to be in most cases a purely local affection, and to be properly treated by local remedies. At the same time to effect a cure by any process is avowedly difficult, and so eminent an authority as Scanzoni does not remember that he has been fortunate enough to cure any instance of several years' standing. Recent improvements, however, in the way of medication and local treatment afford much greater promise of effecting cure than formerly, particularly where the disease is confined to the canal of the cervix. The less obstinate forms of the affection are indeed sometimes efficiently treated by the use of astringent vaginal injections and medicated pessaries. By way of saving the patient the inconvenience of direct applications, necessitating frequent vaginal examinations, such methods as can be carried out by the patient herself may first be tried. Thus, injections of the salts of zinc and alum, and carbolic acid sufficiently diluted, of tannin and perchloride of iron, thrown against the os uteri by an efficient douche may be employed. The iron alum recommended by Dr. Tyler-Smith in his work on leucorrhœa, is a very valuable astringent for this purpose. Independent, however, of the effect of astringents dissolved in the injection, much good is sometimes attained by the diligent use of plain water in a vaginal douche; and a stream of cold or tepid water made to play forcibly against the cervix uteri night and morning for a considerable period, often gives fresh tone to the parts, and promotes ultimate cure. Tannin, gallic acid, common and iron alums, carbolic acid, persulphate and perchloride of iron, may also be used by the patient herself in the form of pessary, the horizontal posture being maintained during their solution, and the pelvis being elevated to insure the flow upwards of the melting material. Probably the most powerful astringents used in this form are the perchloride of iron and the iron alum.

In more obstinate and intractable cases further treatment becomes absolutely necessary, and various methods have been proposed for applying remedies more certainly to the interior of the uterus. Thus, solutions of nitrate of silver, sulphate of zinc, chromic acid, tincture of iodine and acid nitrate of mercury, have been injected into the uterine cavity by means of a properly curved silver catheter with an attached syringe. Unfortunately all such irritating injections are apt to produce severe uterine colic, with grave nervous disturbance, unless the quantity of fluid injected be very small, or unless the os uteri be so patent as to permit the speedy discharge of the liquid. Both acute metritis and peritonitis, and in very sensitive patients alarming convulsions, have followed such proceedings. To obviate this inconvenience it has been proposed first to dilate the os uteri with a sea-tangle or sponge-tent, and inject immediately afterwards. The tangle-tent in dilating often provokes more severe pain than the sponge-tent, particularly if there be any rigidity of tissue, so that the latter should be preferred. Dr. Emmet of New York maintains that the elastic dilating pressure of sponge-tents of itself is an efficient means of diminishing hypertrophied conditions of the cervix and of curing granular erosions there. Be this as it may, the use of a sponge-tent has, besides opening up the os uteri to permit the escape

of injected fluid, the obvious advantage of expanding the deep folds of mucous membrane lining the cervix and thus exposing the surface more fully to the agent employed. It is thus an especially important aid in treating chronic inflammation of the cervical canal. The crypts here are ordinarily so clogged with viscid mucus that to insure the same end M. Huguier recommends scarification of the interior of the cervix before cauterization there. After dilatation and the careful removal of mucus by small pieces of sponge or suction with a syringe, one or two drachms of tincture of iodine, solution of nitrate of silver (grs. xx ad ℥j), or solution of perchloride or iron with glycerine, may be injected, and repeated according to circumstances, a fresh dilatation with sponge-tents being made on each occasion.[1] When using strong injections it is desirable to use a glass speculum, so that the fluid in returning shall flow as little as possible over the vagina, and it is especially important not to throw an injection into the upper part of the cavity of a flexed uterus, as the fluid may be retained above the bend and entail all the evils of a contracted os uteri. Some practitioners prefer the application of solid substances to the interior of the uterus to intra-uterine injections, and for this purpose various medicated astringent bougies and porte-caustiques have been invented. M. Huguier applied solid nitrate of silver after superficial incision before mentioned. Sir James Simpson was in the habit of introducing a piece of solid lunar caustic into the uterine cavity, which in dissolving spread itself over the mucous membrane. M. Courty recommends the same method, and speaks highly of its efficiency, while he has not met with any untoward results from the practice. Dr. Athill and others strongly advise the application of fuming nitric acid to the cavity of the uterus after dilatation and other suitable precautions, and urge that the practice is neither hurtful nor painful. Professor Thomas, of New York, advocates the use of medicated tents, containing iodine, chromic acid, &c. These are passed into the uterus once a week and allowed to remain for some time, so that the medication may come thoroughly in contact with the whole surface. A plan recently recommended by Dr. W. S. Playfair is to carry concentrated carbolic acid by means of a flexible metallic probe armed with a thin covering of cotton-wool as far into the uterus as may be possible. A patulous condition of the orifice favors its introduction. The pure carbolic acid rendered fluid by the addition of 20 per cent. of water may be used in this way from time to time without causing much pain. It possesses advantages over both nitrate of silver and acid nitrate of mercury employed by some practitioners, and undoubtedly answers very well in many cases. To get the full effect, the tough mucus must first be carefully removed from the mucous membrane by bits of sponge or cotton-wool on a probe before applying the acid. The perchloride of iron dissolved in glycerine (℥j ad ℥j), may be applied in the same way. This agent has the peculiar property of so thoroughly coagulating the viscid mucus lying in the cervical canal, that it forms into dry crumbs, and thus enables the canal to be thoroughly cleared before using a second probe medicated either with iron perchloride or with carbolic acid. Pledgets of cotton-wool furnished with a string to facilitate their removal and soaked in tannin and glycerine, or perchloride of iron and glycerine, may be applied to the os uteri twice or thrice a week, and sometimes answers very well. Even plain glycerine used in this way promotes cure, in virtue of its penetrating power and capability of attracting other fluids. Dr. Braxton Hicks uses pencils of sulphate of copper, iron, zinc, and alum, which have been cast in a thin mould the size of the cervical canal; and Dr. Matthews Duncan speaks highly of the utility of zinc alum, a compound of zinc and alum similarly prepared. These methods of treatment are especially applicable to the forms of endometritis in which the disease is chiefly confined to the cavity of the cervix. In certain cases where the effect of chronic metritis has been to produce a permanent alteration of the glandular and villous structures, and a thickened and fungous condition of the lining membrane attended by menorrhagia or the frequent admixture of blood with leucorrhœal discharge, Sir James Simpson, Dr. Routh, and others have suggested that the cavity should be scraped by a curette with a cutting edge, somewhat similar to the curette of Recamier, and Dr. Routh afterwards applies tincture of perchloride of iron, iodine, or other substances to the abraded surface, by way of inducing more healthy action. Incision of the cervix has also been recommended as preliminary to other treatments, and is indicated if the external os is much contracted. It may be observed, however, that the greater the interference by such violent methods, and the stronger the local application, so is the risk of lighting up fresh complications. These forms of treatment, therefore, should be reserved for exceptionally obstinate cases. There are few instances which do not ultimately yield to some of the less violent methods previously described if the general health be

[1] Mr. Coxeter, of Grafton Street, and other instrument makers, sell small syringes specially adapted for uterine injections.

at the same time improved. The waters of Ems, Selters, and Luhatschowitz are held in much esteem on the Continent, for their efficacy in uterine as well as other forms of catarrh. Of these the springs of Ems enjoy the greatest reputation, and although the waters have been probably overrated as remedies for all the forms of chronic metritis, there can be no doubt of their utility in cases of chronic uterine catarrh. The thermal vaginal douche of the Bubenquelle spring is a very powerful remedy in this affection, but its use needs carefully regulating, as incautiously employed it often gives rise to considerable pain, and indeed the too prolonged or unguarded use of the Ems waters in any way frequently gives rise to much constitutional feebleness and relaxation. To remedy any debilitating effects so produced it is commonly recommended that the patients shall take a supplementary course of chalybeate waters at Schwalbach, Spa, or Pyrmont, or combine some Schwalbach waters with the waters of Ems while pursuing the course at that place.

Concerning the treatment of abrasions, erosions, and ulcerations of the os and cervix uteri, much controversy has taken place, and the questions as to whether local treatment is required, and as to what extent, and kind, have been hotly contested. There would seem to be some ground for believing that local methods of cure have been carried to an extreme by some practitioners who take too limited a view of the nature of these alterations, and do not appreciate their true pathological import. Dr. Edward Rigby, indeed, did not scruple to aver that certain medical men had behaved dishonestly in having recourse to local applications when uncalled for, and hinted that cauterization had, within his experience, been practised simply to impress the mind of the patient.

Viewing these deviations from healthy conditions as strictly analogous to pathological changes of like character occurring in other parts of the body (and from this aspect alone can any rational principles be laid down for their treatment), it is obvious that the same form of procedure is not applicable in all cases, but that variations of condition require modifications of treatment. It would be the merest empiricism to cauterize all forms of surgical ulcer, and equally it is an excess of zeal, often most injurious in its effects, to treat all erosions and ulcerations of the os uteri in this way. Recollecting that a large proportion of these abrasions and erosions do not reach the stage of true ulceration, and often bear a resemblance both in appearance and pathological import to the granular conjunctiva, or it may be to a crop of herpes on the mouth, it may clearly be inferred in these cases that little local treatment is required. Practically it is found that cleanliness, with rest and careful attention to the constitutional condition which may have been the cause of the local ailment, is sufficient for the cure. When further treatment is required, and there are evidences of local relaxation, the cold or tepid alum hip-bath, consisting of half a pound of powdered alum dissolved in three gallons of water, proves a useful adjunct, and, in the case of most unmarried women suffering from the simple forms of leucorrhœa, this, with the administration of a ferruginous tonic, or of a mineral acid with a vegetable tonic, and a nutritious diet, is all the treatment required. Further aid may be derived in suitable cases from the use of zinc and alum solutions by vaginal injection. The cold or tepid vaginal douche efficiently managed is a potent remedy for imparting fresh tone to the parts. A Kennedy's or Higginson's syringe may be used for this purpose, or the douche recommended by Dr. Graily Hewitt in his work on the diseases of women. The materials found most useful for medicating vaginal injections are the common and iron alums, chloralum, sulphate of zinc and sulpho-carbolate of zinc, tannin and gallic acid, perchloride of iron, and carbolic acid; Goulard water and infusions of oak bark or matico may likewise be employed. [The special local sedative and detergent properties of iodoform justify its addition to this list.—H.] Recently the various forms of medicated pessary previously alluded to (p. 792) have been much used either to replace vaginal injections, or as additional aids, and when properly managed they have the obvious advantage of keeping the medication for a longer period in contact with the affected part. Further, medicated pessaries have the additional advantage of being appropriately used during pregnancy, when frequent douches and injections may not be employed without the risk of separating the membranes and provoking abortion. In a large proportion of the simpler forms of ulcerative inflammation of the cervix the treatment above described suffices for the recovery of the patient. In more obstinate cases, where, it may be, true ulceration has been produced, or where some complication exists, other measures of treatment will be required. And here it is important to recall the fact that erosions and granular ulcerations of the os uteri are often secondary to other and more important uterine affections, and that to effect a cure of the primary ailment which may have been the cause of ulceration is of the first consequence. Thus the presence of endometritis, of mucous polypus, of uterine displacement, or hypertrophy,

should be sought for, and, if found to be factors in the case, should be appropriately treated. In all cases, the cervix should be kept as much as may be from the injurious influence of friction. Coitus should be forbidden, and, if prolapsus is present, the womb should be supported by a ring horseshoe, or other pessary which cannot chafe the granular surface. Where there is habitual congestion, or, it may be, thickening and induration associated with ulceration, and particularly if at the same time there be pain and tenderness, the local abstraction of blood by leeches or scarification, in accordance with the rules laid down in a previous page, will be an essential preliminary to other treatment. Instead of astringent injections and pessaries, more soothing remedies must be employed, and warm hip-baths and injections of warm poppy decoction, or of lead and opium, may be substituted. Instead of astringent pessaries, those containing morphia, belladonna, and atropine may be prescribed. Occasionally mercurial ointment, bromide of potassium, iodide of lead, bismuth, and oxide of zinc are combined with a sedative in this form. The dry powders of calomel, bismuth, and oxide of zinc have also been shed by various contrivances over the affected parts. When there is much tendency to excoriation, heat, or pruritus, borax may be combined with a sedative either in injection or pessary. Hydrocyanic acid with emulsion of bitter almonds, or hydrocyanic acid and solution of morphia, may be added to Goulard water in the proportion of two drachms of the former ingredients to eight ounces of the last. If there be offensive irritating discharges the permanganate of potash and the sulpho-carbolates in lotion give marked relief. Attention also has recently been drawn to boracic acid lint as a potent application for pruritus.

When tenderness has for the most part subsided, and the indications of active and progressive mischief in the deeper structures are in abeyance, the persistence of a granular condition or ulceration of the cervix may necessitate some form of cauterization, or the application of some astringent stronger than can safely be employed in the form of injection or pessary. The agent which has been most extensively used for this purpose is lunar caustic, and Dr. Henry Bennet and other eminent authorities speak very highly of its efficiency. The nitrate of silver is so readily decomposed by the mucous discharges, that the surface needs to be carefully cleansed by cotton-wool or bathed with water before its application. Solutions varying from twenty to sixty grains to ℥j of distilled water are to be preferred when the granulations are very vascular, as then the use of the solid caustic often provokes bleeding. The weaker solutions are best suited to the more irritable forms of ulcer, the stronger to the more sluggish and insensible. An application of this kind once or twice a week commonly suffices. Other materials used in the same way are carbolic acid, perchloride of iron, tannin and glycerine, Richardson's colloid styptic, the sulphates and chlorides of zinc, sulphate of copper, the acid nitrate of mercury, butter of antimony, chromic acid (℥ss to water ℥j), nitric acid, iodoform, &c. All the stronger substances require the use of a speculum so as to insure the limitation of the medicament to the part affected. Less potent and less irritating solutions may be applied by means of Sir Charles Locock's tube—a glass syringe open at its extremity and furnished with a sponge which can be projected beyond it. Carbolic acid possesses special advantages for the purpose of these applications. It does not leave indelible stains on linen like nitrate of silver, and, as pointed out by Neumann of Vienna, it causes the tissues to shrink and their fluids to coagulate, while it rarely makes even the most vascular surface bleed. It may be successfully applied in its concentrated form to the exuberant development of villi, which has been called "cock's-comb" granulation, and to the sort of hæmorrhoidal condition of the os uteri, consisting of eversion of the mucous membrane, with distended capillary vessels, described by Sir J. Y. Simpson. Unlike potassa fusa and other strong caustics, it does not leave an eschar, and thus is not likely to be followed by after contraction of the cervical canal. It may be applied in small quantities to the part with a brush in its concentrated form, enough water only being added to make it fluid, or a small pledget of cotton-wool soaked in the glycerinum acidi carbolici of the *Ph. Br.* may be pushed through a speculum to the affected part, and there allowed to remain some hours covered by a larger one soaked in simple glycerine. When the morbid condition extends upwards in the cervical canal, the application should be made to follow it there, so as to insure a more complete healing. Its effect in promoting rapid cure is sometimes remarkable. When there is much thickening or induration in the deeper structures subtending granular erosion or ulceration, the tincture of iodine as before mentioned may be preferred to any of the more direct astringent or caustic remedies, as to promote absorption in the deposit beneath is the best way to insure the healing of the broken surface.

Whether it is desirable in cases of considerable and obstinate hypertrophy of the cervix, associated with ulceration, to have recourse to more severe forms of

cauterization, is still a debated question. Sir J. Y. Simpson recommended the use of potassa fusa under the circumstances. The part being well exposed in a glass speculum, a stick of caustic potash is pressed firmly upon any thickened part, until a slough is produced; the parts being freely bathed with acetic acid immediately after to limit the effect of the escharotic. The object is to stir up healthy action in the part, and favor ultimate absorption of the exudation. Sir James asserted that in a day or two after such cauterization the slough separates and leaves a healthy sore on a softened cervix, which soon heals under the application of some astringent injections or pessaries. Dr. Henry Bennet, another eminent authority, prefers the potassa c. calce, a somewhat diluted preparation, with the same objects; and intimates that it may be necessary to make the application several times, the application being each time limited to a small space. M. Joubert de Lamballe and other practitioners in France employed the actual cautery, and the recent improvements in the forms of galvanic and gas cauteries have greatly facilitated the application of the actual cautery, and do not so readily alarm the patient. Unfortunately there are grave objections to the frequent use of these powerful escharotics, and they should consequently be reserved for exceptional instances. The contraction of the cervical canal thus produced may subsequently so interfere with the escape of the menstrual discharge as to lead to severe dysmenorrhœa. Dr. Bennet has further pointed out that the use of potassa c. calce, although it may not inflict much pain, produces great prostration of strength; and there can be no doubt that caustic potash frequently leaves among its after effects severe uterine neuralgia. The use of strong escharotics is nevertheless justifiable when partial nodular hypertrophies are present which resist milder forms of treatment, and which provoke frequent hemorrhage; and the same may be said of the fungoid condition produced by simple hypertrophy of the papillæ and glandular follicles around the os uteri, under similar circumstances. Some of these hypertrophies only involve one labium uteri, and consequently there is no occasion to apply the cautery to the whole circle of the os uteri.

In most other cases absolute rest, local depletion, counter-irritation, small doses of perchloride of mercury, and careful attention to diet, regimen, and those minor measures found useful generally in uterine complaints, will promote the recovery of the patient with less risk and almost as certainly as the employment of strong caustics. In the rarer instances where the hypertrophy of the cervix is so considerable as to prove a serious inconvenience to the patient, the amputation of the part is rather to be recommended than the slow and uncertain action of repeated cauterization.

In the local treatment of uterine affections, it is on all accounts most desirable that vaginal examinations in married women should be reduced to a minimum consistent with the recovery of the patient. In virgins, frequent local applications by a medical practitioner are commonly both uncalled for and injurious, and it is only when all other measures have failed, and the condition of the patient urgently demands further interference, that they are justifiable.

Lastly, whenever patients, the subjects of chronic uterine inflammation, have been much enfeebled by the persistence of the malady and the treatment necessary for its subjection, some after-treatment with a view of restoring the strength of the patient becomes essential. Thus a change from town to country or to the sea-side, where bathing may be had, is followed by a marked advantage. If the patient suffers from amenorrhœa or is anæmic and feeble, the waters of Spa, Schwalbach, Pyrmont, and the mud baths of Franzenbad may be prescribed. If there be an impaired condition of the digestive organs and abdominal circulation, the spas of Vichy, Kissingen, Homburg, Carlsbad, &c., may be recommended in accordance with the special requirement of each patient. Schlangenbad and Wildbad have a large reputation for calming the nervous affections associated with uterine disorders.

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GROWTHS IN THE UTERUS.

By John Williams, M.D.

FIBROID TUMOR.

Synonyms.—This form of new growth has received many names, as Scirrhus, Sarcoma, Fleshy tubercle, Steatoma, Subcartilaginous tumor, Fibroma, Myoma, Myo-fibroma, Dermoid, and Hysteroma. Fibrous or Fibroid Tumor is the term by which it is now most usually known, and serves perhaps as well as any other the purposes of designation and distinction.

History.—Though known to the ancients, yet until recent times it was confounded with growths of a much more serious character, for it was regarded as being of the nature of cancer. William Hunter first pointed out its true character, and called it "Fleshy tubercle." Yet Ashwell, more than fifty years afterwards, strongly maintained that it was a cancerous production, and gave five reasons in support of his belief, "not a single one of which is entitled to any weight." Its real structure was described by Vögel in the year 1843. He showed that it was composed of tissues similar to those of the uterus. Since that time it has been definitely ascertained that the growth, whether it occurs in the pregnant or the unimpregnated organ, possesses a structure very similar to that of the wound itself.

Pathological Anatomy.—A uterus may be the seat of a single fibroid growth, or of many. Seldom, however, is this form of tumor found solitary; several usually grow in the same organ; two or three, or as many as twenty or thirty, or more, may be present in the same uterus. It does not usually attain a great size. It varies from the size of a walnut to that of a fœtal head. Occasionally, however, it may attain very large dimensions, and cases have been met with in which the abdomen was enormously distended by the growth, and in which after removal the tumor weighed seventy or eighty pounds. On the other hand, the growth may be so small as to be overlooked even on a careful examination. I have in my possession a specimen which is not distinguishable by the naked eye, and which was accidentally found while making a microscopic examination. It is a common occurrence to find growths no larger than a pea or a bean.

Fibroid tumors, when simple, are usually spherical in shape, have a smooth surface, and are lodged in a capsule of fibro-cellular tissue, which separates them from the uterine tissue around, and out of which they can be readily enucleated. Their attachment to the uterus is by a slender cord of fibrous tissue, in which small bloodvessels run. They are hard, resisting, and creak under the knife. On section they present a somewhat undulating surface of a grayish, whitish, or reddish-white appearance, exhibiting opaque white or pearly-white striæ interlacing in various directions. Sometimes these striæ have a concentric arrangement around a central nucleus. These consist of fibrous tissue and muscular fibre cells in varying proportions, but the former always predominate. The muscular fibre cell appears to be somewhat larger than that found in the empty uterus, but smaller than that in the impregnated organ. The meshes formed by the fibrous bands contain a

grayish-white substance, composed of round and elliptical cells, and these, with the fibres forming the bands, are bound together by a transparent structureless or slightly fibrillar matrix. Several such simple fibrous masses of smaller or larger size may be bound together within the same capsule, and thus form a conglomerate fibroid tumor. Such tumors differ not in structure from the simple forms just described, except that they are less dense and more vascular. The individual masses of which such compound or conglomerate growths are formed, by reason of the pressure resulting from their contact with one another, lose their spherical form, and assume various irregular shapes. They are separated from each other by processes of connective tissue proceeding from the capsule which surrounds the whole. The surfaces of such conglomerate masses are lobulated and irregular in consequence of the uneven projections of the growths entering into their formation. They possess a kind of hilus with a large venous plexus, from which veins proceed between the lobes of the tumor along the processes of connective tissue found there, receiving in their course minute venous branches from the growth. Opposite the hilus, the wall of the uterus presents a cavernous structure. While the veins are of considerable size, the arteries supplying fibroid tumors are usually minute. They enter in the band of connective tissue by which the tumor is attached to the uterine wall and ramify in the tumor. Attempts at injecting the arteries of fibroid tumors have in some instances failed. This was probably due either to some peculiarity in the growth itself, as commencing degeneration, causing occlusion of the vessels, to imperfect fluidity of the material injected, or to imperfected manipulation, for usually there is no difficulty in injecting the vessels of growths of this nature, and when injected with a solution of carmine their section presents a deep pink color, though no vessels of any size can be distinguished in them. Though the hard fibroid tumors are usually but little vascular, it is important to bear in mind that this is subject to exception, and that occasionally an artery as large as the radial supplies the growth. The bearing of this fact upon the surgical treatment of fibroid tumors is evident.

Besides the dense, hard, whitish, little vascular growths just described, there is another variety of fibroid tumor which is less often met with, and which it is important to distinguish, for it differs from them in character, and requires a different method of treatment. This form is softer than the one described, grows to a larger size, and sometimes simulates the pregnant uterus in shape and consistence, so that some difficulty may be met with in discovering the real condition present. Barnes says: "These tumors are not so often multiple as the hard fibroid: they almost invariably affect the body of the uterus: they attain a large size: they are softer, looser, more like muscle, have often interspaces filled with serum: they are more disposed to become 'fibrocystic:' they are not so often encapsuled. They are much less disposed to calcareous degeneration. They are more liable to become œdematous. They are more vascular, and therefore more prone under surgical interference or other violence to become inflamed, to undergo necrosis, to give origin to septicæmia and peritonitis. They are less prone to become polypoid. They frequently give rise to profuse menorrhagia."

The usual seat of fibroid tumors is the body and fundus of the uterus; it is rarely they are met with in the cervix, and still more rarely in the vaginal portion. They may, however, grow wherever tissues similar to those of the uterus occur, and they have consequently been met with in the vagina, Fallopian tubes, ligaments of the ovary, and the broad ligaments. Fibroid tumors are the most common form of uterine neoplasms. They are very common. According to Bayle, they are found in twenty per cent. of women who die after the age of thirty-five, while Klob says that they occur in forty per cent. of women who die after the fiftieth year. Dr. Charles West found fibrous tumors in the uteri of seven women out of seventy who died after the age of puberty, examined by him at St. Bartholomew's Hospital. Mr. Pollock states that of 580 who were examined by him at St. George's Hospital, nine only contained fibroid growths. Braun and Chiari assert that out of 2494 post-mortem examinations made in both sexes, in twenty-five instances were fibroid tumors found. The value of the two last statements in the estimation of the frequency of fibroid tumors is slight, inasmuch as the first refers to the condition found in women of all ages, and the second includes not only all ages but also the male sex. Though the statements of Bayle and of Klob are usually regarded as great exaggerations, yet there are no statistics which disprove them, while the results of Dr. West's investigations show that the growths under discussion are far from infrequent at all ages after puberty. It may fairly be concluded, not only that fibroid tumors are of common occurrence, but also that they exist in many instances without any troublesome or serious symptom. The course of fibroid tumors when not interfered with and when left to nature is pretty well known; and this knowledge is of immense value, for it has suggested

methods of treatment appropriate to certain grave conditions arising in the course of the disease, which have in many instances proved successful. Though not uncommon after the twentieth year, fibroid growths of the uterus have not been met with before puberty. They originate during menstrual life, while the uterus is active, between the twentieth and the fortieth or forty-fifth years, rarely if ever after the menopause. The period of their growth is also usually coincident with the period of uterine activity. This must be ascribed to the peculiar periodical changes which take place in the uterus during this period of life. There can be no doubt that a fibroid tumor lodged in the walls of a uterus partakes in some degree in the changes which take place in that organ, whether they be menstrual, senile, or the result of impregnation; and yet the morbid growth has a sort of independent existence. After the menopause they usually, though not always, cease to grow. During pregnancy they enlarge rapidly and become softer, and after delivery they may undergo involution just as the uterus diminishes in size. On the other hand, they may grow when the uterus is apparently quiescent. Their growth is often if not always in excess of the uterine enlargement. They sometimes continue to grow after the menopause; and after labor a fibroid growth may undergo involution to such a degree as to disappear altogether, or it may remain almost undiminished in size, or slough and be expelled in its entirety, or in fragments. What may be the relation of these changes in the uterus and in a fibroid tumor to the influence of the ovaries is somewhat uncertain, for considerable evidence has recently been brought forward to show that the periodical changes in the uterus are independent of ovarian influence. Though neither the dependence of menstruation issue, nor its independence of ovarian action has been established, yet there are reasons for believing that the presence of the ovaries has a considerable influence on fibroid tumors. Cases have been recorded in which the ovaries were removed with a view to relieve the hemorrhage due to fibroid tumor and the operation was followed by markedly beneficial results, and such cases appear to show that the presence of the ovaries favors one at least of the most troublesome and dangerous symptoms arising from fibrous growths.

Their rate of increase varies in different subjects and in the same subject at different times. This is a matter of observation and experience. The hard and little vascular growths increase slowly, while the softer variety grows more rapidly. In one case we have seen a fibroid growth, which was so small that it could only be suspected because of the profuse hemorrhage present, and of a local induration of tissue felt immediately within the inner orifice after the cervical canal had been dilated by means of tents, attain the size of a walnut in a few weeks; while in another instance a tumor the size of an egg remained stationary for years. After the menopause they usually cease to grow, and often diminish in size; there are, however, numerous exceptions to this rule, in which growth proceeds rapidly after the change of life has taken place.

Fibroid tumors may undergo a variety of changes, some of which are of a temporary character, while others result in the arrest of their growth or in their complete removal. It is well known that the uterus gradually enlarges as the menstrual epoch approaches, and diminishes rapidly again during the flow. Fibrous tumors partake in this enlargement — the increased flow of blood through the uterus causes an increased flow of blood through the tumor, and it increases in size and diminishes again when menstruation has set in. We have seen this menstrual increase in a fibroid growth which was lodged in the pelvis so marked as to cause complete retention of urine just before the appearance of the catamenial flow.

Fibroid tumors occasionally decrease in size permanently and without regard to menstruation. This appears to be due to the occurrence of œdema in the whole or a part of the growth and its subsequent absorption. Though the whole tumor may become œdematous, usually a part only becomes thus affected. When localized the fluid may or may not be surrounded by a cyst-wall. Paget says: "These formations of cysts are not rare in fibroid tumor, especially in such as are more than usually loose textured. It may be due to a local softening and liquefaction of a part of the tumor, with effusion of blood into the affected part, or to an accumulation of fluid in the interspaces of the intersecting bands; and these are the probable modes of formation of the roughly-bounded cavities that may be found in uterine tumors. But in other cases, especially in those in which the cysts are of smaller size, and have smooth and polished internal surfaces, it is more probable that their production depends upon a process of cyst-formation corresponding with that traced in the cystic disease of the breast and other organs."

Empty cavities are not infrequently found in fibroid tumors, and it is supposed that at one time such cavities were the receptacles of fluid. The fluid became absorbed, the cavities remained empty, and such an occurrence would readily account for the diminution in size occasionally

observed in fibroid growths. In other instances the cysts are filled with blood or pus.

Occasionally these cysts form a considerable part of the growth, and the evidence of the presence of fluid in the tumor is apt to mislead and suggest the presence of ovarian disease, for tumors of the ovary are usually cystic, while those of the uterus are solid. A mixed cystic and fibroid growth of the uterus is called "fibro-cystic." It is rare. It may attain a very great size, filling and distending the whole of the abdomen.

In some instances fibroid tumors undergo calcareous degeneration. They become hard, and have been described as bony. No true bone or cartilage is, however, ever found in them. The change consists in a deposition of the salts of lime and of other bases in their fibres, and is analogous to calcification of the arteries. This deposition may take place in their centre, or be scattered in an irregular manner through their substance. Sometimes it occurs in concentric laminæ, and when this happens in the superficial layers the growth becomes inclosed in a calcareous shell or covering. In other cases the whole tumor is involved in the degeneration. This is one of the modes in which nature cures or removes the tumor or arrests the progress of its growth. The calcified mass loses all vital connection with the uterus, and may be expelled by the vagina. This is the uterine calculus of old authors, the nature of which was first suspected by Dr. Matthew Baillie. The calcareous mass may, however, remain *in situ*, neither growing nor diminishing in size, nor giving rise to any symptoms.

It has been denied that fibroid tumors ever undergo atrophy and absorption; their hard and dense character naturally leads us to regard their disappearance in this manner as highly improbable; but the evidence bearing on this point shows that in some rare cases the disappearance of a fibroid tumor by this process really does take place. Several well-authenticated instances of such disappearance are on record, and its occurrence is now too well affirmed to be doubted. It appears to have been first observed in the unimpregnated organ by Sir Charles Clarke. The absorption of fibroid tumors during the process of involution following delivery has been repeatedly observed to take place by Scanzoni and Playfair.

Spontaneous detachment of a fibroid tumor may take place by the natural efforts of the uterus, by the expulsive action excited in the organ by the growth. Many, if not all, fibroid tumors originate in the substance of the wall of the uterus and are intra-mural or interstitial in position. Some of them remain in this situation throughout their course, while the position of others with regard to the surfaces of the uterus becomes altered. When they grow towards the mucous surface and project into the uterine cavity, they are called submucous. When they grow towards the peritoneum and project into the serous cavity they are named subperitoneal. These three varieties of fibroid tumors, according to their position in the wall of the uterus—the submucous, interstitial, and subperitoneal—it is of great importance to be able to distinguish clinically, because the treatment to be adopted, especially the surgical part of it, depends greatly upon the variety of the growth. There are two causes which play a part in bringing about a change in this position; one is the growth of the tumor itself. As it increases in size it necessarily projects in the direction of least resistance, that is, in that direction where it is covered by the least thickness of muscular tissue. If this be on the mucous side of it, the growth becomes submucous; if on the peritoneal side of it, subperitoneal. This, however, is not the only agent, nor the most powerful, for the presence of the growth in the uterine wall excites contraction of the uterine fibres. A hard, solid mass, unyielding, denser than the tissue of the uterine wall, in which it is imbedded, forms an object favorable to the action of the womb. It gradually becomes pushed towards the mucous or serous surface, and there forms a protuberance. Frequently, indeed most usually, the expulsive process is carried but little farther, and the tumor remains partly imbedded in the muscular wall, partly projecting beyond its surface. Occasionally, however, the process does not stop at this stage, but the uterine action succeeds in extruding the offending mass out of the uterine tissue on to the mucous or serous surface, so that it becomes lodged in the cavity of the uterus, or in that of the peritoneum, being attached to the uterine walls by a pedicle only. The pedicle of a subperitoneal variety is usually more slender than that of the submucous. It consists almost entirely of connective tissue and vessels covered by peritoneum; while the pedicle of the submucous variety is usually short, tough, and contains, in addition to connective tissue, a large quantity of muscular fibre cells. There is necessarily, from the manner of the production of pedunculated fibroid tumors, a stage in which they are sessile, and this condition may continue. When, however, the tumor has arrived in the cavity of the womb, muscular action becomes more violent and energetic, and the organ acts upon the foreign body at a greater advantage than when it was lodged in its tissues; expulsive actions are engendered and the mass is driven

into the cervical canal, the walls of which gradually yield under the pressure from above. Ultimately the tumor may be driven through the cervical canal into the vagina. Meanwhile the pedicle becomes elongated and more slender, and if it be sufficiently yielding, the growth may be expelled through the vaginal orifice, and even completely detached. This, however, is not a frequent termination. The pedicle is usually stout and unyielding, and offers great resistance, and the tumor remains in the uterus, or is driven down into the cervical canal or upper part of the vagina only.

Now and then, when the tumor is attached to the fundus of the uterus, and when the pedicle is unyielding, the contractions of the organ become so violent as to cause its inversion, partial or complete, and the tumor then lies in the vagina, the fundus uteri forming its base.

The subperitoneal variety is frequently pedunculated. Usually the pedicle remains short. Curious results may follow from the action of the abdominal organs upon a tumor projecting on the surface of the uterus into the peritoneal cavity. Professor Turner says, "should a subperitoneal tumor be attacked by inflammation of its peritoneal investment and contract adhesions to its surrounding parts, it is placed in a position favorable to become separated from the uterus. This would be specially liable to occur if it became connected to a viscus, such as the bladder or rectum, which is continually undergoing changes both in size and position. The alternate dilatation and contraction of these viscera would necessarily exercise a considerable traction upon the tumor, which would tend to produce elongation of the pedicle; and ultimately, should the cause be sufficiently long in operation, complete detachment from the uterus. Even if the tumor were to attach itself to a fixed part, as the pubes or other portion of the pelvic wall, and the woman subsequently became pregnant, the growing uterus gradually rising into the abdomen might exercise such an amount of traction upon the pedicle as to attenuate it even to complete separation. The entanglement of the tumor between the walls of the small intestine which so frequently hangs down into the pelvic cavity, even though no distinct adhesions took place between them, would, during the peristaltic movements of the gut, exercise a certain degree of dragging upon it, especially if at the same time the pedicle became twisted. In those cases in which the tumors attain great size or great density, through calcareous degeneration, even without becoming adherent to adjacent parts, their own weight might probably assist in producing attenuation of the pedicle; but in estimating this as a cause productive of separation, we must always bear in mind the reciprocal pressure exercised upon each other by the walls and contents of the abdominal cavity."

The pedicles of subperitoneal tumors, though usually short, may acquire such length as to permit the growth to appear to float freely in the cavity of the abdomen, or to contract adhesions to distant organs as the liver or stomach. By separation of the pedicle the tumor may become actually free in the peritoneal cavity. In this condition it may remain perfectly innocuous, giving rise to no trouble of any kind, and the freely floating mass remains unchanged in structure. When a fibroid growth has contracted adhesions to other organs dangerous results may follow, for such adhesions may, by their contraction, or by peristaltic action of the intestine, constrict the gut and cause complete intestinal obstruction.

The subperitoneal variety is more prone to undergo calcareous degeneration than the other varieties of fibroid tumors.

Fibroid growths, even when lodged in the wall of the uterus, are liable to undergo a process of softening and disintegration. In this manner their whole substance may become a soft pulpy mass, or may be broken up into fragments and be discharged by the vagina or rectum. When expelled by the latter channel, adhesions form between the peritoneal surfaces of the growth and rectum, and the wall of the latter breaks down, making a way for the disintegrated tissue to escape into the bowel. Opinions differ with regard to the nature of the process. Sir James Simpson regarded it as sloughing —the result of inflammation. West on the other hand does not think that inflammation plays any part in bringing about the disintegration. "The process," he says, "seems to be one of death of the tumor, but the mode in which it is brought about is by no means clearly understood. It is not a process of inflammation nor of its ordinary results. The fibrous tumor when attacked by inflammation, presents a vivid rose red color, and shows a greatly increased vascularity, while local pain and the general signs of inflammation attend the process during the patient's life. The disintegration of the tumor on the contrary takes place unattended by symptoms which could lead to a suspicion of what is going on, and the outgrowth becomes soft and breaks down into a dirty putrilage." When a fibroid tumor has become pedunculated and lodged in the cavity of the uterus, the mucous membrane over its lower and most contracted part may become gangrenous. The whole tumor may ultimately become involved in the gangrenous process and be completely

removed; or, instead of attacking the lower part of the growth, gangrene may involve the pedicle, and the mass become detached while still lying in the uterine canal, and then be expelled by uterine contraction.

It has been doubted whether fibroid tumors ever undergo cancerous degeneration. The general opinion is that it never happens, and there is every reason for believing that they have no tendency to become malignant, for there is only one case recorded where a fibroid growth of the uterus had become primarily cancerous. That case was described by Klob. He says that he placed in the Salzburg Museum a specimen of a fibroid tumor which had partially undergone cancerous degeneration, while there was no trace of cancer to be found in any other part of the body. If we accept this, we must admit the possibility of such degeneration, while we must also believe that such an occurrence is of infinite rarity. Fibroid tumors may, however, become involved in the progressive extension of cancer, for cancer may attack a uterus containing a fibroid tumor, and the latter may become involved as the former extends.

When a fibroid tumor has attained any size it always gives rise to some deformity of the uterus. The organ is enlarged and often displaced. The enlargement in some cases appears to be uniform, while in others it is not symmetrical. It is due to two causes, the presence of the tumor itself and a hypertrophy of the uterine walls. The amount of the latter varies much in different cases. It is greatest when the tumor is submucous or interstitial, and least when it is subperitoneal. With the latter variety the uterus may become atrophied and be represented by a thin membrane only. The misplacement and deformity in shape of the organ may be of any kind, prolapsus or procidentia, elevation above the brim of the pelvis, version or flexion backwards, forwards, or laterally, or a twisting of the organ in such a manner that its canal is almost zigzag.

Fibroid tumors do not preclude pregnancy. Still, it is not common for impregnation to take place, and when it does it may lead to disastrous consequences. Abortion may take place, and very profuse hemorrhage, or gestation may proceed to the full term, and natural delivery may prove impossible, and recourse to craniotomy or the Cæsarean operation become necessary. Should delivery be effected in the natural way, the patient has still great risks to run from post partum hemorrhage, primary or secondary; from disintegration of the tumor in consequence of injury received during the birth, inflammation and pyæmia or septicæmia.

Sexual intercourse without impregnation appears in some cases to call attention to the presence of a fibroid growth in the uterus which had not been suspected before. The increased activity of the generative organs consequent upon marriage may give rise to hemorrhage, and rapid growth of the tumor, and in some instances apparently to its destruction.

The causes of fibroid tumors are unknown. They are met with in every condition of life, in the married and the single, the fruitful and the barren. The negress is said to be specially obnoxious to these growths, while she suffers much less frequently from cancer than the white woman. Dr. McClintock believes that the scrofulous temperament is favorable to their production. They are frequently associated with neoplasms of the ovary. Sterility has been said to predispose to their formation, but there is no evidence to support this opinion, while there is no doubt that sterility is often entailed by their presence. Old standing menstrual disorders have also been credited with predisposing to their development, but when we bear in mind the slow rate of increase of these growths, we can hardly resist the conclusion that in persons who are the subjects of fibroid tumors, such disorders are the result of their presence while still small and unrecognized.

Symptoms.—The symptoms of fibroid tumors vary greatly. There may be no symptoms whatever present, the patient being unconscious of anything wrong until she discovers an enlargement of the abdomen or a hard swelling above the pubes. This is more especially the case when the growth is of the subperitoneal form. When symptoms are present, and they usually are, there is no single symptom or combination of symptoms which is characteristic of the affection and which may not arise from other disease than fibroid tumor. There is generally a sense of weight in the pelvis and a dull aching in the sacral and lumbar regions. Menstruation is frequently, but not always, disordered. There may be severe dysmenorrhœa, and often there is hemorrhage. The hemorrhage may occur at the menstrual epochs only, and may be moderate in quantity, or be so excessive as to blanch the patient, to produce exhaustion, or even prove fatal. Frequently the menstrual bleeding is prolonged during a part of the inter-menstrual interval, and at a later period of the disease it may continue during the whole of the monthly period; or the catamenia may return every fortnight, or hemorrhage of a profuse character may occur at irregular intervals without any regard to the epochs of menstruation. When the hemorrhage is limited to the menstrual epoch it is

called menorrhagia, when occurring at other than those times metrorrhagia.

The bleeding is evidently due to several causes, and much difficulty is found in explaining this part of the subject. It has been maintained that the source of the hemorrhage was the surface of the tumor. In favor of this view it was urged that the bleeding ceases on the removal of the growth, or even on the application of a ligature to its pedicle; that the membrane covering the growth is highly vascular, and that the pedicle may contain vessels of considerable size. It has, on the other hand, been affirmed that the source of the hemorrhage is the inner surface of the body of the uterus, and in support of this view it has been stated that small growths cause as profuse hemorrhage as large ones, that the most frequent form the hemorrhage takes is menorrhagia, and that it is well known that the source of the menstrual blood is the interior of the body of the womb. Dr. West has brought forward one of the strongest reasons for believing that the hemorrhage comes from the surface of the body of the uterus. He says, "A woman came under my care, who for three years had suffered from profuse hemorrhages, which had ceased without known cause, for three months before I saw her. The non-appearance of the menses did not engage my attention as it ought to have done, and I accordingly excised a fibrous polypus the size of a small hen's egg, which grew by a short pedicle from the inside of the cervix. . . . . For three years the polypus had irritated the womb, and blood had been abundantly poured out. Pregnancy took place, there was increased flow of blood towards the part, but no bleeding occurred." It is not exactly true that bleeding always ceases when the pedicle is tied, for several instances have occurred in which profuse hemorrhage followed ligation. On the other hand, the surface of the tumor is very vascular, and when injured may bleed profusely, and it does appear from this that the bleeding takes place from the whole of the mucous surface of the body of the uterus, whether it forms part of the covering of the tumor or no. In all cases the tumor is covered by mucosa, and there is no sufficient ground for supposing that any part of the mucous surface of the uterine body does not contribute to the hemorrhage.

By reason of the growth of the tumor and the irritation caused by its presence, a greater quantity of blood than in health flows in the vessels of the uterus, and consequently the vessels opened during menstruation are larger than those opened at the same period in health, and permit a greater loss of blood. When the seat of fibroid tumor, the uterus is enlarged, its cavity is elongated, and as the hemorrhage has its source in the whole of the surface of the body, it may be expected to increase in proportion to the increase in the area of that surface. There are many exceptions to this, and a very large fibroid tumor may be present while the menstrual flow is normal in amount. This is probably to be explained by, among other reasons, a lesser development of menstrual decidua. This I had an opportunity of verifying in a case of ovarian tumor, in which the cavity of the uterus measured four inches in length. Menstruation, though too frequent, was normal in amount. The patient died when menstruation was expected, and it was found that the decidual development for menstruation was extremely slight. From the congested condition of the inner surface, and the fact that the epoch was due, it was evident that menstruation was impending.

The position of the tumor in the uterine wall affects in a very marked degree the amount of the hemorrhage. The subperitoneal variety frequently gives rise to no bleeding, while the submucous generally gives rise to profuse bleeding. When again the tumor grows in the cervix, or at the junction of the body and cervix, the hemorrhage may be very profuse, though the outgrowth be very small. This is probably owing to obstruction to the flow from the uterus caused by the presence of the tumor at that particular spot. The discharge is dammed back, the uterine cavity becomes distended, the potency of the bleeding vessels is maintained, and the hemorrhage continues. This view of the case is favored by the fact that when a free exit is made for the discharge by incision of the cervix, the menorrhagia often diminishes greatly or even disappears entirely for a time. Fibroid tumors may also cause hemorrhage by exciting uterine contractions. The mucous lining of the uterus is soft, its vessels fragile. The tumor is hard and resistant. Contractions of the uterus upon such a body would inevitably lead to injury of the soft mucosa, rupture of its vessels and bleeding. It is not improbable that it is in cases of this kind anodynes act as hæmostatics. The causes of the hemorrhage thus appear to be many and complex, but it appears to me that on the above principles the varieties in the amount of the loss in different cases may be explained. Hemorrhage may be absent or moderate for a long time, and then become suddenly, and without apparent reason, profuse and dangerous. In seeking an explanation for such phenomena, the curious and singular effects of slight causes, as change of residence,

sea-bathing, and others, upon menstruation when the uterus appears healthy, should be borne in mind.

Other discharges than blood are almost constantly associated with fibroid tumors. They are usually white or yellow, mucous or muco-purulent. They are sometimes watery or serous. They are usually odorless, but occasionally become as offensive as the discharge from a uterus affected with cancer, and may lead to a suspicion of the presence of that disease. Symptoms due to pressure on other organs often appear early. The bladder becomes irritable. There are frequent calls to micturate. The bowel is pressed upon, there are hæmorrhoids, frequent desire to go to stool and rectal tenesmus. Owing to the increase in weight, the uterus descends in the pelvis and may become prolapsed or procident. As the tumor grows, if it remain in the pelvis, the bladder and rectal symptoms may become urgent. There may be complete retention of urine owing to the pressure on the neck of the bladder. More rarely there is complete obstruction of the bowel, owing to its peculiar position in the pelvis. There are signs of pressure on the nerves of the sacral plexus, severe pain in the pelvis, numbness, and cramps in the legs; and of pressure on the veins giving rise to œdema of the lower extremities and vulva.

Diagnosis.—From the rational symptoms it is not possible to recognize the presence of fibroid tumor of the uterus. These with a physical examination will, however, in the great majority of instances, suffice to establish the diagnosis. In some cases this is easy, in others very difficult, and in a few impossible. If the uterus be freely movable, and the growth of moderate size, no difficulty will be met with. Immobility of the uterus, on the other hand, will occasion great difficulties. It may be confounded with pregnancy. Fibroid tumors which are likely to be confounded with pregnancy, usually give rise to hemorrhage, and the tumor formed by them is harder and firmer than that formed by the pregnant uterus. When, however, the tumor is of the soft variety, the last-named character is not available. The changes in the vagina and the cervix will be of assistance, and it may be necessary to make an ocular examination with a view to detect any change of color in these parts. Should all means fail, time will in such cases clear the obscurity. Pregnancy may be complicated with fibroid tumor. The want of uniformity in the enlargement of the uterus, or bulging at a particular part, and an undue enlargement for the period of pregnancy will give indications of such a condition.

When pregnancy has been excluded we may use the uterine sound with the view of measuring the length of the uterine canal, and the thickness of the uterine walls. Before using the sound, however, a careful bimanual examination should be made. This method of exploring the pelvic organ is most useful and trustworthy, and should in no case be neglected. By it we can in the majority of cases determine the size, shape, weight, contour, position, and movability of the uterus. In many cases such an examination alone is sufficient to establish the diagnosis. It is, however, not available in all cases, especially in those in which the abdominal walls are loaded with fat or the abdominal muscles are extremely rigid. When it fails the sound should be used.

From flexion of the uterus fibroid tumor may usually be readily distinguished by the combined method of examination alone, for flexion can readily be detected when the organ is held between the two hands. Should this method fail, the uterine sound should be introduced, the canal measured, and the uterus, if displaced, be restored to its normal position. If the tumor still remains when the uterus is replaced, it is probably a fibroid tumor. If it disappears, there may still be a fibroid tumor present, and the organ should therefore be examined by the bimanual method while maintained in position by the sound.

By a combined examination through the rectum and the vagina it may be ascertained whether the growth is situated in the anterior or the posterior wall of the uterus. The uterus should be drawn down as far as is consistent with safety, and the sound introduced into its cavity: the finger in the rectum can now estimate the thickness of the posterior uterine wall, and distinguish whether any enlargement behind the uterus grows from the uterus or from the pelvic wall. By a similar method the finger in the vagina can readily estimate the thickness of the anterior wall of the uterus, or the presence of any new growth in that situation.

Cases in which fibroid tumors situated in the posterior wall of the uterus have become fixed by adhesions to the peritoneum around present the greatest difficulty. It is sometimes impossible to determine whether the thickening be due to fibroid tumor, pelvic cellulitis, or pelvic peritonitis. When the history fails to make the condition in such cases clear, we must trust to time alone for the solution. It should be borne in mind that both fibroid tumor and pelvic peritonitis or cellulitis may be present together.

The diagnosis from ovarian tumor will be given when treating of that disease.

Treatment.—The treatment is both medical and surgical. In this place we shall speak of the former only, the latter being beyond our limits. The medical

treatment of these growths is chiefly palliative and consists in the prevention of hemorrhage, the relief of pain, and the maintenance of the general health. In some rare cases, however, much may be done towards effecting a cure, and indeed cases are known in which fibroid tumors have completely disappeared during the administration of drugs. In the arrest of hemorrhage, no therapeutic means is of greater value than rest. The rest should be absolute, physical and functional. The patient should remain in bed, and should not move out of it for any purpose. She should not get up to empty the bladder and bowels. Hæmostatics are often called for, as tannic or gallic acid, acetate of lead and opium, sulphuric acid, cannabis indica, vinca major, bitartrate of potash, alum, capsicum, oil of turpentine, sesquisalts of iron, Ruspini's styptic, digitalis, ipecacuanha, mercury. Any one or all of these when tried may fail, and then it may become necessary to plug the vagina and cervix uteri.

Acetate of lead and opium has answered well in my hands, but every now and then it fails; gallic acid or some other member of the group has, however, proved most effectual in other hands. When acetate of lead is administered, the patient should be carefully watched, for though usually no unpleasant results follow the administration of the drug, yet in some rare instances symptoms of acute lead-poisoning set in rapidly after a few doses of it have been taken. Should this occur, the administration of the salt should be at once stopped and Epsom salts given instead.

In some cases perchloride of mercury has succeeded when all else has failed.

With a view of effecting a cure several medicines have been in use. When treatment is undertaken with this view, it should be distinctly understood that the prospect of causing absorption of these growths is exceedingly slight, and that no treatment can be of any avail unless persisted in for a prolonged period. Iodide and bromide of potassium have been given with this object. The iodide is administered by the mouth and also applied in the form of an ointment to the abdomen and to the cervix uteri. Its effects are by no means of a satisfactory character. For some years the bromide of potassium has been much used. It is administered in ʒss doses three times a day, and this should be continued for months. It is said to produce favorable results, but though I have tried it extensively, I have not been able to discover that it has had any effect whatever on the growth of the tumor.

Chloride of calcium is another remedy which has been given with a view to arrest the growth of fibroid tumors. It is given with a bitter or with a salt of iron if the latter be indicated, and its administration continued for months. There is a danger connected with its use. It is said to arrest the growth of the tumor by causing calcification of its arteries. Were this process of calcification limited to the tumor, chloride of calcium might be a very valuable remedy; the salt, however, acts in a similar manner on the vessels of the body generally, and thus brings about a condition more dangerous than the one for the cure of which it is given.

Ergot of rye is known to give rise to contractions of the muscles of the gravid uterus, and is supposed to have a similar influence over those of the unimpregnated organ. Ergotine—supposed to be the active principle of ergot—has during recent years been used in the form of injections under the skin for the cure of fibroid tumors, and some favorable results have been obtained from its use. Its disadvantages are that it gives rise to severe pain, redness, and inflammation, and often abscess at the seat of puncture. More recently a substance called sclerotic acid has been obtained from ergot, and it is said to be its active principle. It is soluble in water: six drops of water will dissolve one grain of the acid. The dose is half a grain, or three drops of the solution. It causes some irritation around the puncture, but less than ergotine. I have never seen abscess follow its use. I have used it in one case with marked results. A patient, aged thirty-five years, suffered from a large fibroid tumor, reaching three fingers' breadth above the umbilicus. She had continuous hemorrhage, and was unable to move out of bed. The sclerotic acid was injected under the skin twice a week; the hemorrhage ceased in the course of six weeks, and menstruation became regular in the course of a few months. The general health improved, and the tumor now reaches to the umbilicus only, and the patient is able to walk about, go up and down stairs with ease and comparative comfort. From a single case it is not possible to draw reliable inferences as to the value of the remedy, but it should be stated that when on two occasions the injection was suspended for a month, the hemorrhage returned, and when recourse was had to the remedy again, the hemorrhage ceased.

Cysts.

Small cysts are not uncommon in the mucous membrane of the cervix; they are also met with in that of the body. They are the result of cystic degeneration of the follicles and utricular glands; Rokitansky, however, thinks that some of them are new formations. They are rarely larger than a hemp-seed, but occa-

sionally attain the size of a small cherry. Their contents are fluid, viscid, or caseous.

Cysts in the substance of the uterine wall are infinitely rare. Small collections of serum occasionally form under the peritoneum, but they are not surrounded by a cyst-wall.

Dermoid cysts containing hair and teeth have been found in the uterus.

True hydatid cysts have also been seen in the organ.

Carswell has figured a vascular erectile tumor of the uterus, and Klob has described a vascular outgrowth which he believed had its seat at the point of attachment of the placenta. The origin of the growth he refers to a paralysis of that part of the uterus to which the placenta was attached, and a consequent imperfect involution of the part; an explanation which, to say the least of it, is somewhat fanciful.

Polypus of the Uterus.

All growths attached to the inner surface of the uterus or to the vaginal portion of the cervix, be they sessile or pedunculated, are called polypi. Malignant growths are, however, generally not called polypi, though they may assume a polypoid shape.

Polypi of the womb vary very much in structure, and are in consequence variously classified by different authors. Here they will be described under the following heads and in the following order:—1. Fibrous polypus; 2. Mucous polypus; 3. Fibrinous polypus; 4. Placental and vascular polypi.

Fibrous polypus of the uterus is much less common than fibrous tumor. Indeed it appears to be the ultimate condition of one of the forms of the latter—the submucous. Fibrous polypus originates as a submucous tumor. By its own growth and the contractions of the uterine wall, it gradually emerges from its bed in the substance of the organ in the manner described under Fibroid Tumors, and becomes lodged in the uterine cavity. It may remain closely attached to the wall of the womb, and then it is sessile or it may become stalked or pedunculated. It is of a round or pear-shape, the large end being directed towards the orifice of the uterus. Its surface is of a pink, deep red or purple color, smooth, and sometimes presents small outgrowths, which give the mass an irregular shape. It is covered by a mucous membrane, which is a continuation of that lining the uterus, which bleeds freely when subjected to manipulation or injury. In structures the growth resembles fibroid tumor; it consists of fibrous tissue mixed with a varying proportion of muscular fibre. In some instances the growth is hard, in others somewhat soft and fleshy, and is then analogous to the softer variety of fibroid tumors. Occasionally cysts are found in its substance; it is then called fibro-cystic polypus. It varies in size, but never attains the enormous size that some fibroid tumors acquire. It may, however, be so large as to completely fill the pelvic cavity. In the great majority of cases it has its attachment to the body or fundus of the uterus. The latter is said to be its most common seat. Not rarely, however, it grows from the anterior or posterior wall of the organ. Occasionally, but very rarely, it originates in the cervix, and in some instances from the lips of the os uteri. The pedicle may be slender and fine, or thick, stout, and fleshy. It consists of connective tissue mixed with muscular fibre-cells from the parenchyma of the uterus, and bloodvessels. Sometimes it is formed by a duplication only of the mucous membrane passing from the uterus over the growth. Its blood supply varies much. The vessels are usually small, and the pedicle may be cut through with scissors without fear of hemorrhage; but occasionally a vessel as large as a goose-quill supplies the growth.

The polypus, when lodged in the uterus, acts as a foreign body, excite contractions of the uterus, and gives rise to severe pain and profuse hemorrhage. In consequence of the increased action of the organ, a hypertrophy of its substance takes place, and the uterus becomes enlarged, so that whenever a tumor of this kind has been removed, the wall is found thickened. The uterine contractions may, if the pedicle be slender and yielding, expel the polypus out of the cavity of the organ, or throw it off completely, as described when speaking of Fibroid Tumors.

If the pedicle be thick and flat, other and serious accidents may happen. When the growth is attached to the fundus, the tumor, driven down by the uterine contractions may, on account of the unyielding nature of its pedicle, drag the fundus with it, and cause more or less inversion of the organ. This may proceed to such a degree as to cause complete inversion of the uterus and inversion of part of the vagina. The tumor as well as the fundus of the uterus would then be outside the vulva.

Fibroid polypus is liable to changes like those which take place in fibroid tumors. Inflammation, gangrene, fatty degeneration, and softening occasionally attack them, and these processes may result in their complete destruction, removal, and cure; on the other hand, absorption of the decomposed tissues may take place, and death follow.

As a consequence of inflammation, a fibroid may become attached to any part of the genital canal—the vagina or uterus.

Calcareous degeneration, it has been said, takes place more rarely in the submucous than in the subperitoneal variety of fibroid tumor. It is rarely seen in polypus.

Polypus does not absolutely prevent conception. Owing, however, to the irritation and inflammation set up by its presence, and to the mechanical impediment occasioned by it, especially when lodged in the vagina or cervix uteri, it is rare for conception to take place. When it occurs the pregnancy is associated with grave dangers. Abortion is not unlikely to take place during the earlier months; and should gestation run to the full term, as occasionally happens, danger is not over. Hemorrhages frequently occur during its course, and after delivery profuse and fatal bleeding may happen. Should, however, the hemorrhage be arrested immediately after the birth, if the tumor be left *in utero*, bleeding may occur again during the puerperal period, while if the growth be excised the patient runs a serious risk of pyæmia. For this reason, by universal consent, operations on the puerperal uterus are, if possible, avoided.

The chief symptom of polypus is hemorrhage. In some rare instances this sign is altogether absent, however. It shows itself at first as excessive menstruation. There is menorrhagia. Later it occurs at any time, irrespective of the menstrual epochs. In quantity it varies greatly, and this variation appears to be independent of the size of the tumor. It appears to be more profuse when the growth is lodged in the cavity of the womb, and occasionally it ceases altogether when the polypus has been expelled into the vagina. The bleeding may be so great as to prove fatal.

There is leucorrhœa. The discharge may be purulent, mucous, or serous. It is usually odorless, or has but a slight, unpleasant odor. Occasionally, however, it is extremely offensive, and this is due to its retention in the genital passages and consequent decomposition. There are sacral and lumbar pains, and while the growth is lodged in the cavity of the womb severe expulsive pains, which cease entirely when the mass has been expelled into the vagina. The bladder is irritable: there is frequent desire to micturate; there may be incontinence; if the tumor be large it may press on the neck of the bladder and cause complete retention, or on the ureters, and give rise to hydronephrosis and uræmic poisoning. The rectum may be disturbed in its functions; there may be hæmorrhoids, mucous diarrhœa, or constipation from pressure. Like fibroids, they may press also on the nerves and vessels passing through the pelvis, and cause pains, cramps, and œdema in the lower limbs. Owing to the mechanical impediment offered by them to the exit of the menstrual and other discharges from the uterus, the Fallopian tubes may become dilated and regurgitation of the accumulated secretions may take place into the peritoneal cavity, or rupture of the uterus may occur in consequence of ulceration of its wall following pressure on it.

The general health of patients suffers variously, according to the amount of the hemorrhage and leucorrhœa and their duration. Anæmia is often present. The complexion becomes sallow, earthy; the stomach gets out of order, the appetite is lost, the tongue is furred, and the bowels are constipated. Later on, nervous and hysterical symptoms are not infrequently present, and in some cases a feeling of great depression. When fibrous polypus is still lodged in the uterus, and the os remains undilated, the diagnosis is impossible. The uterus is enlarged and hard, and the presence of a submucous fibroid may be recognized. If, however, the cervix be dilated by the efforts of nature, or artificially by tents, no difficulty will be met with in recognizing the nature of the case. If the finger can be swept freely round the uterine cavity the size and attachment of the pedicle can be discovered. This cannot usually be made out by means of the sound alone. If the lower part of the polypus ulcerates and becomes gangrenous, it may be mistaken for cancer, but a careful examination will reveal the lips of the uterus intact, and the pedunculated, fibroid nature of the growth. From mucous polypus it is distinguished by its hardness; it should be remembered, however, that true fibrous polypus has occasionally a soft texture. From sarcoma and cancer of the body of the uterus microscopic examination gives a certain means of distinction. Fibrous polypus, if left alone, may cause death by producing exhaustion as a result of frequent hemorrhage and constant discharge, or as a direct result of profuse flooding, or by septicæmia in consequence of breaking down of the tumor. The prognosis is generally favorable, however, if the growth be removed. No treatment is of any avail until the tumor has been excised. When this has been accomplished the hemorrhages and discharges cease, and the patient soon regains health.

Mucous Polypus.—Under this term are included those circumscribed growths which involve only the superficial layer of soft tissue on the inner surface of the uterus. These have received various names, depending to a certain extent upon their structure, and their relation to the uterine glands and follicles, as vascular, vesicular, cystic, channelled,

tubular, and glandular polypi. They may grow from any part of the inner surface of the uterus. Some maintain that they rarely grow from the surface of the body, but this is evidently an error. Klob states that they are very frequently found in that situation, especially in the organs of aged women. I have met with such growths in the body of the uterus of a young woman, twenty-three years of age. In the cervix they may form simple projecting folds of membrane, or assume the form of sessile or pedunculated growths, from the size of a pea to that of a walnut. The follicles so abundant in the mucous membrane of the cervix uteri are not infrequently the subjects of enlargement and cystic degeneration, and take part in the formation of mucous polypi. The process may involve one follicle only, and this may attain the size of a pea, or a small bean; or a large number may be affected at the same time, and the canal of the cervix be filled by them. They remain partially in the wall of the uterus and project into the cavity simply by reason of their size, or they become dislodged, either alone or associated with an outgrowth of the mucous membrane, or become pedunculated and form a polypus. In the course of this process many of the follicles burst, and others then enlarge and take their place, but by rupture of successive follicles the mass may assume a harder and firmer texture, and its original structure be disguised. The process may affect any follicle in the course of the canal, or on the vaginal surface of the uterus, but more commonly those situated in the lower portion near the external uterine orifice are involved.

These growths are soft, smooth, round, or lobulated, and of a red color. The pedicle may be slender, and of considerable length, even so long as to permit the tumor to hang outside the vulva, or short and stout; while in some cases they are sessile, and appear as simple outgrowths of the mucous membrane. They are covered by a layer of epithelium, columnar or tesselated, according as they grow from within or outside the uterus. On section the vesicular structure is readily seen. The vesicles may appear as small roundish cysts of various sizes, or as tubes or channels, having their course directed towards the surface. They usually contain a viscid, slightly yellowish fluid, and occasionally a little curdy matter. The pedicle is formed of connective tissue, bands of which spread between the vesicle, forming a sort of stroma, the proportion of which increases as successive vesicles rupture. In some cases the vesicular structure entirely disappears, and the stroma, with some cicatricial tissue, is alone left. Then the growth consists of a hardish mass, which may develop into a papilloma if the stroma continue to grow.

The growth may remain in the uterine canal, or it may be extruded into the vagina. In the latter event the pedicle becomes elongated, and the polypus may be ultimately thrown off. Very commonly mucous growths are sessile, and attached to the uterus by a broad base. Mucous growths of the body of the uterus are less common than those of the cervical canal, and they are far less frequently diagnosed. They occur in the single as well as in the married, in the young as well as the old, but more especially in women after the climacteric, who suffer from chronic inflammation of the uterus. They grow at any point of the cavity, but more often near the isthmus, or the orifices of the Fallopian tubes. These growths are of various shapes, sometimes they form flattened elevations, or folds, on the surface of the uterus; in others they are round, or mushroom-shaped, and pedunculated. They usually project but a few lines only above the surrounding surface, but now and then they attain the dimensions of a strawberry. In large soft uteri which have undergone imperfect involution after labor or abortion, a peculiar granular condition of the mucous membrane is frequently found which may possibly be due to an imperfect removal of the old and effete decidua lining the uterus, the portions which remained having acquired a new life.

When projecting into the vagina mucous polypi are usually readily recognized. The speculum may be necessary for this, for they, by reason of their softness, may escape the finger. When in the cervix, and within reach of the eye, no difficulty can be met with in distinguishing them. When, however, they are in the body of the organ, and beyond the reach of the finger or sight, it is in many cases impossible to detect them. If a tent be introduced to dilate the cervix so as to admit of exploration of the uterine cavity, mucous growths situate in the upper part of the cervical canal, or just within the internal orifice, may disappear entirely, in consequence of the pressure exercised upon them, while if they remain unaffected by it they may elude detection by the finger by reason of their softness. When of considerable size a soft outgrowth can be readily recognized. If a portion of it be removed microscopic examination will distinguish between it and sarcoma of the mucous surface.

These formations are said to be the result of chronic catarrh of the mucous membrane.

The treatment is surgical, and consists in their removal.

The *fibrinous and placental polypus* are

not outgrowths of the uterus, and therefore cannot be regarded as true polypi. The former appears to be either a coagulum of blood poured into and retained in the uterus, and become more or less decolorized and attached to the organ at a particular part; or an ovum which has attached itself to the uterus, and into which blood has subsequently escaped. The placental polypus consists of a portion of the placenta which has remained *in situ* after labor, and preserved its organic connection with the uterine wall. Their nature can be recognized only after removal, which should be effected as soon as the growths are discovered, for both varieties give rise as a rule to profuse hemorrhage.

Papillary Tumors of the Uterus.

These may be benign or malignant. The malignant belong to the epithelial variety of cancer. The benign usually affect the vaginal portion of the cervix. They are generally small, but sometimes acquire a considerable size, and form the cauliflower excrescence of the uterus. The cauliflower excrescence, however, is more often malignant than benign in character. The growths may be few or many, simple, club-shaped, or branched. They are of a red color, soft texture, and consist of the hypertrophied papillæ of the cervix; they are amply supplied with bloodvessels, and are covered with a thick layer of epithelium. The symptoms are a serous watery discharge, sometimes stained with blood; irregular and profuse hemorrhages may be present, in consequence of which the general health may suffer. They may atrophy and die, or they may undergo cancerous degeneration. This should be borne in mind when treating these growths. Their early removal when discovered, before any sign of malignancy makes its appearance, is imperative, and should be effected as far as possible from the seat of the growth, in healthy tissue.

Villous growths of the uterine canal are rare. I know but of three cases, two of which have been published, and the third was reported to me by Dr. W. R. Gowers. The first case was read before the Royal Medical and Chirurgical Society by Dr. Snow Beck in 1873 (*Proceedings*, vol. vii. p. 199). It occurred in a spinster aged fifty-nine years. Irregular hemorrages came on four years before death, together with a profuse whitish or yellowish discharge, without any previous symptoms of ill health. The discharge had at first no offensive odor, but towards the end it became very offensive. There was no ache or pain throughout. "The appetite became impaired, and ultimately extinguished, the tongue red coated and tremulous, the bowels always constipated, pain at the epigastrium after eating, much flatulency, frequent sickness, distressing hot flushes, occasional giddiness, and sleepless nights. There was comparatively little loss of flesh, and nothing in the general appearance to indicate serious disease. She died with a sudden gush of hemorrhage from the vagina.

"The uterus was somewhat enlarged, the cavities filled with a soft shaggy tissue, which hung down for about an inch and a half into the upper part of the vagina, and filled this portion of the canal. With the exception of a thin shell at the fundus, the whole of the contractile or muscular tissue of the uterus was converted into a soft shaggy tissue, which ceased abruptly at the external orifice, where the vagina begins. With the aid of the microscope the contractile fibre cells were seen slightly altered; lower down they contained in their substance a varying amount of pus globules; still lower down all form of the contractile fibre cell was lost, and, instead, collections of large-sized fat globules mixed with diffluent tissue were seen; and at the lowest portion it consisted of structureless diffluent tissue, mixed with numerous and various sized fat globules."

The case examined by Dr. Gowers was in some respects similar. It was that of a lady, over fifty years of age, who was the subject of progressive muscular atrophy. She was sterile and had had irregular hemorrhages from the vagina and profuse serous discharge. During life no change could be discovered in the condition of the uterus. After death the organ was found to be somewhat enlarged, the os and vaginal portion of the cervix appeared to be healthy. The cavity of the uterus was filled by villi growing from the whole of its surface. They terminated abruptly at the internal orifice.

The third case was reported by Dr. Lusk to the Obstetrical Society of New York, and was published in the American Journal of Obstetrics, for January, 1878. The subject was a single woman, forty years of age, who had never been pregnant. Menstruation began in the fifteenth year and continued regular until the thirty-eighth. After that date it became profuse and painful. There was also a yellowish watery discharge and expulsive pains. The canal of the uterus measured three and a half inches. The os uteri was small. It was incised, and a soft pulpy intra-uterine growth was detected and removed. It returned again. It was removed again, and again returned. Ascites appeared from cirrhosis of the cervix, and the patient died.

After death the uterus was found en-

larged. The cervix was atrophied. The cavity of the body enlarged and filled with soft, shaggy masses, which sprang directly from the muscular walls. These were villi covered with epithelium of an almost cylindrical form. No traces of gland tissue or decidua cells were found.

Hemorrhage, profuse discharge, and sterility were present in the three cases. Pain was absent in two, present in one. The vaginal portion was natural to the finger in the three, but in one the growth projected into the vagina before death. The youngest subject was forty years of age. The diagnosis could only be made by dilating the cervix with tents, and exploring the uterine cavity with the finger.

Sarcoma of the Uterus.

Sarcoma affects the uterus under two forms. One—the recurrent fibroid tumor—grows from the parenchyma, like a fibroid polypus, and is attached to it by a broad pedicle. The other is a growth from the mucous surface, is sessile, and has a tendency to involve the whole surface.

The first variety, like fibroid tumor, grows usually from the body of the uterus and rarely from the cervix. It is softer than fibroid growths, breaks down readily when seized by the forceps, sloughs and disappears apparently altogether in consequence of injury such as the removal of a portion of it, but only to reappear again in the course of a few months. In structure it simulates fibroid tumor, that is, it consists of fibrous tissue and muscular fibre cells, but scattered through it are centres of round or spindle-shaped cells. The amount of the latter varies. They may form an inconsiderable part only, or, on the other hand, the chief mass of the growth. It may be expelled from the uterus like fibroid polypus. It grows rapidly, but usually does not attain a large size; occasionally, however, it forms a tumor reaching to the umbilicus. Secondary growths are sometimes found in the lymphatic glands and other organs.

The growths are rare, but may be met with at any age after twenty. Their causes are unknown. It has been supposed that in some instances they are degenerated fibroid tumors. Their symptoms are similar to those of submucous fibroid. There are profuse hemorrhages and serous or watery discharges. The discharge may be odorless or very offensive. During the early stages it is usually odorless. There are pains in the back and expulsive pains due to the efforts of the uterus to expel the growth; but there is no severe pain similar to that of cancer. Symptoms of pressure on neighboring organs may be present if the tumor has attained a large size. The uterus is enlarged in proportion to the size of the growth. The os uteri may appear normal, but in many cases it is dilated and the tumor can be felt through it as a soft mass occupying the cavity of the uterus, or as a polypus hanging into the vagina.

The diagnosis is not easy. A soft, rapidly growing tumor with a broad pedicle, would lead us to suspect its true nature. It is incurable, but does not prove so rapidly fatal as cancer. Sixteen out of thirty cases died within twelve months from their supposed commencement, others have lasted for several years.

The treatment as far as medicine is concerned is that of symptoms only. We cannot affect the growth in any way except by removal and cauterization of the pedicle, and though temporary relief may by this means be given, yet the tumor will sooner or later return and ultimately destroy the patient.

The second variety springs from the mucous surface of the uterus, has no distinct pedicle, and may affect a part or the whole of the uterine surface. It may attain a considerable size and grow out through the cervical canal, forming a large mass, filling the greater part of the vagina. It is of soft texture, its surface is uneven, and when of large size feels as if irregularly branched. In its later stages it undergoes ulceration, and the branched appearance may be due to removal of portions of it by sloughing. It can be torn by the finger without much difficulty, and in this manner portions may be removed for examination. The wall of the uterus may be destroyed by the pressure exercised upon it by the growth or be invaded by the morbid process. The organ, however, continues movable, unless the growth becomes so large as to fill the pelvis, or pelvic peritonitis sets in and adhesions form. This form rarely affects other organs secondarily. It has been met with at all ages after fifteen. It always proves fatal, though early removal may retard its progress.

The symptoms are similar to those of the recurrent fibroid. The diagnosis can be made by microscopic examination only, discovering the structure of a small round-celled, rarely spindle-celled, sarcoma.

The treatment consists in attention to the general health and the alleviation of symptoms.

Cancerous Tumor of the Uterus.

Fibroid tumor we have seen usually affects the body of the uterus, and rarely the cervix. Cancer on the other hand generally begins in the cervix and rarely in the body of the organ. It is found as

a primary growth, but may occur secondarily to disease in the ovary. The scirrhous, colloid, medullary, and epithelial varieties of the disease are met with in this organ. Scirrhus and colloid are rare; the medullary is the most common form and the epithelial occurs next in frequency. At one time scirrhus was believed to be a common affection of the uterus, and this was due to the error of confounding induration and chronic inflammatory conditions of the cervix with cancer. At that time scirrhus was believed to be a disease of slow growth lasting for years, which ultimately broke down suddenly and proved rapidly fatal. The distinction between the two conditions—chronic induration and cancer—is now universally recognized, though in some rare instances the diagnosis between them may remain doubtful for a short time. Paget has not seen a case of scirrhus of the womb. West has never seen an example in the dead subject, but met with it during life in one instance in 187 cases of cancer of the womb. Rokitansky states it is of extreme rarity, while Kiwisch affirms that it occurs three times in ten cases of cancer. The reason of this difference of opinion depends probably on the fact that the disease is rarely seen in its early stages. Klob says that "carcinoma of the uterus, in the majority of cases, occurs in what we might call a fibrous medullary form, that is, in the rare cases in which we are enabled to recognize and study the primary condition of the carcinomatous growth in the dead body we find that form which is described as fibrous carcinoma or scirrhus, whilst in those cases in which the disease proves fatal, we meet with the distinct medullary variety of carcinoma." There appears to be a tendency for the harder form of cancer to pass into the medullary as the disease progresses. Indeed this may be said of the other forms of cancer when they attack the uterus.

Medullary cancer of the vaginal portion grows in the substance of the part, the mucous covering not being at first involved. The lips of the uterus become thickened, hard, and tense. They may be uniformly swollen, or they may acquire a lobulated character. The thickening continues and the vaginal portion becomes greatly enlarged. The os uteri gapes, and the cervical canal becomes more capacious than in health. On section the affected portion is of a whitish-gray or reddish-gray appearance, firm, and the surface furnishes a little turbid fluid on scraping. The mass soon undergoes an alteration, it becomes softer and degenerates into a pulpy, soft, brain-like substance. The mucous membrane becomes involved in the diseased process, and is rapidly destroyed and "an ulcer forms, a ragged uneven sore, with raised irregular ragged edges; and a dirty putrilage, covering its uneven surface, takes the place of the smooth but enlarged lips of the organ, or if the disease go on still further the lips of the womb and its cervix are altogether destroyed, and a soft, dirty, white flocculent substance covers the uneven, granular, and hardened substance which alone mark their former situation." (West.)

The lips and cervix of the uterus having been destroyed, and the softened mass carried away, a large funnel-shaped cavity, having its apex at the internal orifice of the uterus, occupies the place of the os tissue. The mucous membrane of the cervical canal or portions of it may still remain after the removal of the softened tissue, and hang loose in the cavity like a polypus, or a cancerous outgrowth may project into the canal. While the process of softening is taking place the growth advances upwards, involving the cervical tissue; and outwards involving the tissues around, and every stage from the earliest form of cancerous infiltration to that of ulceration may be present at the same time. The disease appears often to be arrested at the internal orifice, but in time it extends beyond that point and involves the body and the fundus. The body of the uterus is generally enlarged as well as the cervix, and this has been ascribed to hypertrophy arising from an increased flow of blood through the part in consequence of the presence of the morbid process. Klob however maintains that the enlargement is in the majority of cases an early stage of carcinoma simply. Ulceration may commence on the surface and extend into the tissues of the cervix; more commonly however it is preceded by softening of the diseased mass.

Cancer may attack one lip of the uterus, or it may appear at first in the form of hard nodules, which grow and meet, and ultimately involve the whole of the cervix. The anterior and posterior lips are affected equally often. When ulceration has taken place the progress of the disease varies a good deal. In some instances it extends slowly, while in others it proves rapidly fatal. It spreads into the surrounding organs. Adhesions form between the lips of the uterus and the vagina, these together with the vaginal walls become involved in the morbid process and form a hard resisting mass. Commonly the upper third or half of the vaginal tube is involved, but in some cases the disease extends almost to the vulva. It may also extend upwards into the canal of the uterus and form warty or polypoid growths in the cavity of the body. Ulcers with or without a cancerous base also are seen in that situation. As the morbid process

advances the tissues around the uterus are invaded—first the peri-uterine areolar tissue. This becomes thick and hard, and the womb is then surrounded by a ring of firm cancerous material. The peritoneum becomes inflamed and adhesions form between the uterus and the bladder and the rectum, and the whole of the pelvic organs become bound firmly together. The glands in the pelvis are usually, but not always affected, while those along the aorta are occasionally so. Later the disease invades the wall of the bladder, it spreads through the muscular coat, and ultimately attacks the mucous lining of the organ, and cancerous growths form on its surface. The mucous membrane is, however, not always affected, but is red, swollen, and inflamed. If the patient live long enough ulceration extends through the vesical wall and lays open the cavity of that organ, forming a communication between it and the vagina, and entails on the sufferer all the pain and discomfort arising from that condition, in addition to the, sometimes, terrible torture of cancer.

The rectum also may be involved in the disease. The growth extends along the posterior wall of the vagina and invades that of the bowel. Adhesions usually form between the surfaces of the pouch of Douglas, and as the ulcerative process advances and involves the wall of the bowel the cavity of the peritoneum is protected and remains usually closed. The mucous membrane of the rectum becomes affected and large masses of villous cancer sprout into the intestine. The bowel may, however, be laid open, and then if the disease has affected the bladder in a similar manner, the urine and the feces are poured into the cancerous cavity occupying the place of the vagina.

Cancerous growths are sometimes found in the peritoneum. They form small tubercles—sessile or furnished with a slender pedicle. Accumulations of serous fluid like cysts are occasionally found between the bands of false membranes underlying the peritoneal surfaces.

The lymphatics, the oviducts, the ovaries, sheaths of nerves, cæcum or pelvic wall may become cancerous by extension.

Secondary deposits, which are less common than in cancer of other organs, have been found in the pelvic and lumbar lymphatic glands, the liver, lungs, ovaries, and most organs of the body.

The anterior wall of the vagina and the bladder are more frequently involved in the progress of the disease than the posterior wall and the rectum. According to West, the posterior lip is more often affected than the anterior.

The epithelial variety of cancerous tumor of the uterus attacks the cervix in the form of a papillary growth. The villi which are abundant on the vaginal portion become enlarged in a varying degree. The enlargement may affect the villi of a small part only, or of the greater part of the vaginal portion, as well as the upper part of the vagina itself. It is rarely that opportunity is had for an examination of this disease in its early stages. Dr. West has had two such opportunities, and I have had one. In my case the cervix was slightly enlarged, and somewhat harder than natural. Upon it were seen irregularly scattered small bright red fine soft villi, which bled readily when touched. In this case the villi did not attain a large size, but ulceration set in early and proved fatal in the course of a few months.

Dr. West says, describing the conditions he saw: "In the first case there was a patch of the size of a shilling on the surface of the posterior uterine lip, somewhat raised above the surrounding surface, of a vivid red color, bleeding readily, and with a papillary structure so fine that it closely resembled the pile of red velvet. In the second case the disease occupied the anterior part of the anterior uterine lip, the outer edge of which felt sharp-cut and everted, and the speculum discovered on it a small patch of abrasion, soft and velvety to the touch, and seen under the speculum to be beset with fine sessile granulations."

In some cases the villi grow rapidly, become branched and form a large soft tumor, filling the upper part or the whole of the vagina. This is the cauliflower excrescence of the os uteri. The cauliflower growth may at first be benign, but is usually malignant. As stated when speaking of papillary growths, benign papilloma, whatever their size, may acquire a malignant character. Epithelial cancer of the cervix breaks down readily, and its base becomes ulcerated, the morbid process invades the neighboring tissues, and afterwards runs a course similar to that of medullary cancer.

It is generally believed that the body of the uterus is not often the primary seat of cancer, though some authorities think this condition is not so very uncommon. There can be no doubt, however, that the disease is very rare, compared with which cancer attacks the cervix. The form in which it is usually found in the body is the medullary, though the scirrhus and epithelial varieties are also occasionally seen there. It grows as one or more nodules or as a tumor in the walls, bulging into the cavity of the uterus, or on the peritoneal surface, or it may assume a papillary or polypoid form; or it may infiltrate the whole of the uterine walls. It breaks down readily into a soft pulpy mass, and the membrane over it becomes necrosed, permitting its escape into the vagina, peritoneum, bladder, or intestines. The growth extends beyond the uterus

into surrounding organs, and adhesions form between the bladder, uterus, or intestines. The uterus is enlarged, sometimes greatly enlarged. The walls, when infiltrated with cancer, are greatly thickened, and the whole of the uterine cavity, to within a short distance of the os tissue, may be obliterated by adhesion of the opposite walls. When the growth is epithelial in character and originates in the surface of the mucosa the uterus is enlarged by expansion, but without marked thickening of the walls. The cavity may measure five or six inches in length. Cancer of the body of the womb is sometimes secondary to cancer of the ovary, or it may be the result of extension from the cervix.

Causes.—The cause of cancer is not known. It is more common in the female than in the male, in the ratio of about five to two, and this is due to the frequency with which the uterus and the breasts suffer. In about a third of all women suffering with cancer the womb is affected. The negress is said to be much less liable to cancer than the white woman; the reverse was found to be the case with fibroid tumor. Age has a marked influence on its frequency. It has been met with before puberty, but it is extremely rare before twenty-five. Its frequency then increases until the age of forty, and attains its maximum between forty and fifty, after which it diminishes; but still the disease has been observed at a very old age. It attacks the single and the married, but the latter much oftener than the former. Sexual excesses are said to favor its occurrence, but prostitutes are not particularly liable to the disease. Child-bearing seems to favor its development, for the average number of children to each fruitful marriage amongst patients affected with cancer is from 5·2 in 7, while the number per marriage in this country is estimated at 4·2. Hereditary taint has been traced by some in about 1 in 6; by others, 1 in 19; giving a mean of 1 in 12·6. Depressing emotions are said to predispose to the disease. It is a curious fact that certain orifices as the mouth, anus, pylorus, and os uteri are favorite seats of the affection.

Cancer of the uterus is rarely seen in its early stages, for at that time it may give rise to no symptoms of such a character as to alarm the patient.

Symptoms.—There are no symptoms distinctive of cancer any more than of polypus or fibroid tumor, and this is especially true of the disease in its earlier stages. Indeed, in the womb just as in other organs occasionally, though unfortunately very rarely, it runs its course to an advanced stage without giving rise to any serious troubles. In other cases symptoms of a troublesome and even of a serious character may appear early, of which hemorrhage, pain, and profuse leucorrhœa are the most frequent.

Hemorrhage in a considerable number of cases appears to be the first indication of anything being wrong. It is this which attracts the patient's attention, and to this she refers the beginning of her illness. It comes on in a gush and may last a few hours or a few days and then cease for months or even altogether: or it may return at irregular intervals throughout the rest of the patient's short life. It may come on spontaneously or after exertion, and not infrequently during coitus. In other cases the hemorrhage takes the form of profuse menstruation, this function being at first performed regularly as to time, but soon becoming irregular and frequent. In women in whom the catamenia have ceased, the hemorrhage occasionally returns periodically, and may lead to the belief that the monthly function of the uterus has been restored. In others, again, it forms a continuous drain, not profuse, and only sufficient to give the discharge a pinky color. In the advanced and ulcerated stages of the disease, the bleeding is often very profuse, and recurs at short intervals. Occasionally it is altogether absent at this period. The source of the hemorrhage is the lining membrane of the body of the uterus, as is shown by the expulsive pains which not infrequently accompany it, its occurrence at an early period of the disease, and its occasional cessation when ulceration has taken place. There can, however, be no doubt that in many cases the ulcerated surface contributes to it in no small degree, inasmuch as profuse and alarming hemorrhage occasionally follows after an examination instituted with every care and gentleness. Indeed, even in the early stages of the epithelial variety, before ulceration has taken place, considerable bleeding may take place from the highly vascular and delicate villi in consequence of examination made by the finger.

Pain in the sacrum and loins of a dull character is always present. The darting, lancinating pain, which is supposed to characterize cancer, is occasionally absent throughout the course of the disease. Pain is usually, though not always, absent during the first period of the disease, while ulceration and extension of the morbid process into the neighboring organs is accompanied by severe suffering. Though more or less constant, it undergoes irregular and severe exacerbations, and the suffering becomes agonizing. With the progress of the disease, attacks of local peritonitis occur accompanied by the pain peculiar to it. The pain increases in severity as the bladder is invaded, and

urinary troubles are then superadded. There is occasionally pain in the ovarian region. As the disease invades the upper part of the vagina, and the nerves and vessels passing through the pelvis, severe pain and anasarca occur in the parts supplied as well, and sometimes that form of œdema peculiar to phlegmasia dolens.

There is at an early period a mucous, muco-purulent or watery discharge. The discharge is most profuse in the epithelial variety, and is then usually of a serous character, often stained of a pink color. At first it had a peculiar and unpleasant, but not offensive odor. When ulceration has taken place it generally, but not always, becomes offensive, and sometimes so offensive that the patient is a burden to herself and to those around her. This is due in part to retention of the discharges in the genital passages, but chiefly to sloughing of portions of the cancer. Urinary troubles are almost constantly present; frequent, painful, or difficult micturition, and occasionally incontinence. If the walls of the bladder have ulcerated through, the urine flows into the vagina. Retention is rare. When the ureters are invaded they may become completely closed, the flow of urine into the bladder is prevented, the parts of the ureters above the constriction become dilated and tortuous, the pelvis of the kidney becomes distended, and the parenchyma of the organ destroyed by absorption or abscess. Occasionally there is extreme hydronephrosis. Nausea may follow, with convulsions, coma, and death. The convulsions and coma do not appear to be due in all cases to uræmia, for in some cases they disappear and the patients live for months afterwards. Extension of the disease to the rectum may give rise to obstruction of the bowel, or to catarrh, and serous diarrhœa. When the recto-vaginal septum is destroyed the feces pass into the vagina.

Nausea and vomiting are frequent symptoms in the later stages. They depend on several causes, but are principally due to the disordered condition of the mucous membrane of the alimentary canal, resulting from the general cachexia. They are said to depend in some cases upon constriction of the ureters.

At the outset of the disease the general health may be good. Sometimes even where there is advanced ulceration the patient may be stout and healthy-looking. This, however, is very rare, for with the destruction of tissue, the hemorrhage and other discharges, the pain and loss of sleep, a peculiar appearance called "cancerous cachexia," is acquired. The blood becomes impoverished, the appetite is lost, the functions of the stomach and bowels fail, the pain prevents sleep, there is great thirst, the tongue becomes furred, then red, glazed, and aphthous. The body wastes, and the patient dies exhausted. This is the most frequent mode of death. Death may result however from hemorrhage, convulsions, septicæmia, coagula in the heart in consequence of thrombosis in the veins of the cancer, peritonitis from perforation or extension of the growth into the peritoneum, or from some intercurrent affection.

In some cases of uterine cancer there is great sexual excitement, and the presence of the disease in the cervix does not unfortunately preclude the possibility of pregnancy. The occurrence of conception is one of the saddest and gravest complications that can happen to the subject of malignant disease of the womb, for the prospect of the birth of a living child is extremely slight, while the life of the mother will be inevitably shortened by profuse hemorrhages, or by the process of delivery. The latter can rarely be accomplished by the efforts of nature, and artificial aid becomes necessary, and this usually in the form of perforation of the fœtal skull, or of the Cæsarean section.

The symptoms of cancer of the body of the uterus are similar to those of cancer of the cervix. There is profuse hemorrhage, fetid discharge, and pain. The pain comes on usually at an early period, while in cancer of the cervix it is often absent or slight until ulceration has set in.

Diagnosis.—The diagnosis of cancer in its later stages is not difficult. The ragged, uneven ulcer with hard edges, bleeding with almost the slightest touch, the fixed uterus, the hardened tissue around the uterus pointing to the extension of the disease into neighboring organs, show only too clearly the nature of the case. In the early stages, when the disease is limited to the vaginal portion, when the uterus is freely movable, there may be considerable difficulty, and this is the more to be deplored inasmuch as it is the time when accurate diagnosis is of the highest importance, for it is also the time, and the only time, for attempting, with a fair prospect, complete removal of the growth with the view of effecting a cure. The only condition for which it is likely to be mistaken is chronic induration of the cervix. In making the diagnosis the following points should be taken into account: The history of the patient; the mean duration of cancer is about eighteen months, while chronic induration lasts for years, and is usually referred back to a difficult labor which happened long before. Hard nodules lying in healthy tissue point to cancer, the hardness of chronic induration is uni-

form. Chronic inflammation of the follicles of the cervix gives rise to hard nodules in an enlarged vaginal portion; these can be distinguished by the speculum, and removed by puncture. The mucous membrane is fixed, and does not glide over the subjacent tissue in cancer. Spiegelberg has suggested the introduction of a sponge tent as a means of diagnosis. In cancer the canal will not dilate; the tissue of the cervix will not yield to the pressure of the tent as it does in chronic induration. Early in cancer the upper part of the cervix loses its defined character, and its limits cannot be made out owing to spread of the disease to the neighboring tissues, while it can readily be defined in chronic induration.

COURSE.—A few cases of cancer of the uterus have recovered through the efforts of nature. The morbid mass has sloughed away, and the disease has not returned. Some have recovered after the part has been removed by operation. These cases, however, are very few in number, and the prognosis is usually only too certain. The disease is fatal. Its duration varies somewhat. The average, according to West, Lebert, and Arnott, is about eighteen months; according to Simpson, two to two years and a half; according to Barker, three years and eight months. The disease may run an acute febrile course, and prove fatal in four months; while, on the other hand, it may last ten or twelve years.

TREATMENT.—Medical treatment is only palliative. We cannot hope to arrest the progress of the disease. There is no drug which in any way affects its course. If discovered early, while still limited to the vaginal portion, complete removal may effect a cure; while in the ulcerated stage even, much may be done by surgical means to arrest its progress, or at least to render lighter for a time the intolerable burden of the sufferer, by arresting hemorrhage and other discharges. Many surgeons, however, think that it is best not to interfere by operative means. The physician's power is limited to the relief of symptoms, and in this even he often signally fails. Functional rest should be enjoined. Marital intercourse should be interdicted because of the risk of hemorrhage, and because the consequences, if pregnancy should follow, would be disastrous; it is moreover believed to favor rapidity of growth. Rest during the menstrual or bleeding periods is necessary. Should the hemorrhage become profuse, astringents are useful. For the pain, anodynes should be administered in the smallest doses sufficient to give relief, beginning with hyoscyamus or belladonna; and as the suffering increases having recourse to opium and morphia. They may be administered by the vagina or rectum in the form of pessaries or suppositories, or by the mouth or under the skin.

For the discharges and fetor strict cleanliness is absolutely necessary. Frequent ablutions and injections containing astringents and disinfectants as alum, lead, zinc, carbolic acid, Condy's fluid, or salts of iron are useful. The bladder and rectum symptoms should be treated as they arise. Great attention should be paid to the stomach and bowels. The diet should be regulated, and should not be too full, and stimulants should be given only in moderate quantities.

PELVIC HÆMATOCELE.

BY WILLIAM OVEREND PRIESTLEY, M.D., F.R.C.P.

DEFINITION.—A tumor formed by the extravasation of blood into the pelvic tissues in the immediate neighborhood of the uterus; and generally associated with some derangement of the menstrual function.

HISTORY.—Pelvic hæmatocele has only lately found a place in medical nomenclature, and until quite recently it was comparatively new to English medical practitioners. With the exception of a notice in Dr. Tilt's "Diseases of Women," and lectures published by Dr. West and Sir James Simpson respectively, British medical literature was a few years ago almost entirely barren on the subject, and few cases had been recorded. The first clear and intelligible account of the affection was published in France, by M. Nélaton, and after the original observations by M. Nélaton on the subject, it furnished a

topic in France for numerous theses, reports, and discussions. Hæmatocele is probably not more frequent in France than in England, for since attention was attracted to the subject, experience has proved that it is of common occurrence in this country as elsewhere; Dr. Barnes has especially drawn attention to its frequency. A numerous array of instances have been chronicled, and many British practitioners have written concerning it, or have made it the subject of discussion in debating societies.

Some of the earliest instances, where the recorded particulars leave no doubt as to the identity of the disease, occurred in the practice of M. Récamier in the Hôtel-Dieu in Paris. One of these was published in the *Lancette Française* July 21, 1831, under the title "Tumeur sanguine du Bassin;" a woman 28 years of age after a miscarriage, had a large tumor in the true pelvis behind the uterus which projected into the vagina, M. Récamier believing it to be an abscess, opened it, but instead of pus, only dark half-coagulated blood escaped from the aperture. In 1841 M. Bourdon in the *Revue Médicale* described the physical signs of blood tumors situated in the peri-uterine cellular tissue of the pelvis, and somewhat later M. Velpeau, in his "Mémoire sur les Cavités Closes," published additional cases, and was evidently acquainted with the true character of these affections. Others were reported by MM. Bernutz and Piogey. M. Bernutz claims priority in having pointed out in 1848 the relation between pelvic blood tumors and disturbance of the menstrual function, but he states that in his opinion the honor of having first discovered true hæmatoceles belongs to Ruysch in 1691. To M. Nélaton, the distinguished Professor of Clinical Surgery in Paris, belongs the merit of bringing this affection into such prominence that henceforth it takes a permanent place in our nosology. In 1850 M. Nélaton drew the attention of his class to the occasional occurrence of fluctuating tumors situated between the uterus and rectum, which, on being laid open, were found to contain extravasated blood. From the position of the tumor he gave it the name of "retro-uterine hæmatocele," a title still applied to it by some authorities, but apt to be misleading, inasmuch as hæmatocele is found in other localities in the pelvis, besides the posterior aspect of the uterus. In 1851 M. Nélaton made retro-uterine hæmatocele the subject of clinical lectures in the hospital, and these were afterwards published in the *Gazette des Hôpitaux*. The description there given is clear and precise, and without detracting from the merits of those who preceded him, it may be said that until M. Nélaton made it a subject of clinical instruction, it was absolutely unknown to the majority of medical practitioners, both in France and elsewhere. It was only in 1850 that M. Malgaigne is reported to have attempted the enucleation of a supposed fibroid tumor of the uterus, which proved to be a collection of blood, and the operation was followed by fatal hemorrhage. The lectures of M. Nélaton having fairly roused attention, and shown that the disease in question was by no means so rare as might have been supposed from the little which had been said and written on the subject, several *brochures* and books speedily followed. Among the first and best of the theses on hæmatocele was that of M. Viguès a pupil of M. Nélaton, and later followed those of MM. Fénerly, Voisin, and others. In 1860 M. Voisin published an octavo volume on "Retro-uterine Hæmatocele and Non-encysted Extravasations of Blood in the Peritoneal Cavity of the Pelvis," and further contributions were made in France by Laugier, Rouget, Fénerly, Puech, and MM. Bernutz and Goupil. In Germany by Virchow, Scanzoni, Braun, Herber, Credé, Breslau, Seyfert, and Olshausen; and in this country by Drs. McClintock, Matthews Duncan, Barnes, Tuckwell, Meadows, and Madge.

NOMENCLATURE AND PATHOLOGY.—The affection has received various appellations, "retro-uterine hæmatocele," "peri-meterine or peri-uterine hæmatocele," "hæmatoma," "pelvic thrombus," and "pelvic hæmatocele." The last seems to be the most comprehensive, and may be employed so as to include all the forms of tumor in the true pelvis formed by extravasated blood, irrespective of locality and apart from the causes or from the several theories which have been promulgated as to the way in which they are produced, always premising that they have their origin in the organs of reproduction. Much discussion, indeed, has taken place concerning the true definition of hæmatocele. M. Nélaton and his followers grouped together under the term "retro-uterine hæmatocele" all the varieties of blood tumor found posterior to or around the uterus, irrespective of their causes. M. Voisin restricts the term to those cases, in which blood is extravasated *into* the peritoneal sac between the uterus and rectum, and further, according to him, the result must be due to some accident of menstruation. M. Bernutz, one of the earliest and most authoritative writers on the subject, insists that M. Nélaton's grouping is irrational, and that uterine hæmatocele is not a specific disease, apart from that which caused it, but is simply a hemorrhage symptomatic of certain morbid conditions, which ought to be the main object

of pathalogical study. Endeavoring to define true hæmatocele, M. Bernutz points out the analogy between the *tunica vaginalis* in the male, and the utero-rectal *cul-de-sac* in the female, the difference between the two only being that the folds of peritoneum forming the *tunica vaginalis* are external to, and shut off from, the abdominal cavity in surrounding the testicle, while in the female the analogous folds of peritoneum subtending the two ovaries together form an open sac communicating with the general cavity of the peritoneum above. Just therefore as he would apply the term "hæmatocele" in the male to a collection of blood in the tunica vaginalis, he restricts the appellation in the female to collections of blood in the retro-uterine pouch of peritoneum, and referring to the *causes*, to those blood tumors only which arise from some accident of menstruation. In Great Britain the term "hæmatocele" in the female is used in a wider and more comprehensive sense, and includes tumors formed by the extravasation of blood not only into the retro-uterine *cul-de-sac* of peritoneum, but elsewhere around the uterus and especially into the cellular tissue in the pelvis, which lies outside the peritoneum. Derangement of the menstrual function is recognized as one of the most fertile sources of pelvic hemorrhage, but other causes also are admitted. Dr. McClintock, in an able paper on this subject, remarks that he "cannot at all agree with M. Bernutz, that to discover the existence of pelvic hæmatocele constitutes only the half, and the less important half, of the diagnosis: on the contrary, it is, I should say, by far the most important half; for if we overlooked the hæmatocele, and were cognizant only of the morbid condition from which it had arisen, what errors of prognosis and treatment might we not commit?" As a practical fact it may indeed be pointed out that the treatment of effusions of blood into the pelvis must in a much larger degree be influenced by the rapidity, extent, and position of the extravasation, than by the pathological condition which caused it, and that although M. Bernutz is doubtless correct in his assertion that the sanguineous effusion is only a symptom and effect of some pre-existing pathological condition in the same sense as menorrhagia may be, yet all M. Bernutz contends for would for all practical purposes be attained by steadfastly bearing in mind that, like menorrhagia or uterine hemorrhage, it may proceed from a diversity of pathological causes.

Again, much controversy has arisen concerning the anatomical situation of the tumor in cases of hæmatocele. M. Voisin and M. Bernutz only admit those cases to be true hæmatocele in which the blood is poured *into* the peritoneal sac between the uterus and rectum. But according to these authors' own showing, instances do occur where blood is extravasated into the cellular tissue around the uterus, and beneath and outside the cavity of the peritoneum. These, however, are rather regarded by them as cases of "thrombus," being akin to those blood tumors which are found occasionally in the external genitals, in connection with the puerperal state, and may be produced by violence, and influences other than those associated with menstruation. It may nevertheless be reasonably argued that it is an unwarrantable violence to separate so far apart these two forms of pelvic blood-swelling as to give them distinct appellations. Both have their position deeply situated in the pelvis; both arise from the rupture of, or escape of blood from vessels supplying the organs in the pelvis; and in both, if the extravasation be sufficiently sparing and slow, the blood becomes encysted. The family resemblance is further borne out by the tendency in both cases to the appearance of the tumor about the time of a catamenial period. It is quite true that the ovaries, the Fallopian tubes, and the uterus are the organs principally engaged in the menstrual act, and any escape of blood from these internally is most likely to flow *into* the cavity of the peritoneum; but it must also be remembered that during menstruation, and especially at its commencement, the whole uterine system becomes more vascular, the circulation in the broad ligaments is increased, the hæmorrhoidal vessels become distended; indeed, all the pelvic organs receive an increased supply of blood, and the abdomen itself becomes fuller. M. Rouget has described an intricate and tortuous plexus of vessels lying just beneath the ovary in the folds of the broad ligament, which, during menstruation and other analogous conditions, become so distended as to form a sort of erectile organ. This he has termed the bulb of the ovary. A condition favorable to the escape of blood exists therefore in all the pelvic tissues when the catamenia recur, and although the mode in which hemorrhage takes place into the retro-uterine *cul-de-sac* of peritoneum may be more obvious than into other situations, yet there is ample evidence to show that blood is occasionally extravasated into the pelvic cellular tissue in such quantities as to form a considerable tumor. Post-mortem examinations have not been so frequent in these cases as to afford any very extensive data to illustrate this point, for there is no doubt that in the fatal cases the extravasation is more frequently intra-peritoneal. Dr. West, in his first edition of "Diseases of Women," has collected the records of eight autop-

sies, and of these we find that in two the blood was poured out behind the uterus and *beneath* the peritoneum; in one beneath the peritoneum in the iliac fossa; and in another between the folds of the broad ligament.[1] Sir James Simpson has published an account of a post-mortem examination, where the blood tumor was unmistakably beneath the peritoneum, behind the uterus, and a diagram shows the manner in which the serous membrane was raised up to form the roof of the cyst. In another of Sir J. Simpson's cases, one of the upper hæmorrhoidal vessels had given way, and produced a blood tumor in front of the rectum. Dr. Matthews Duncan has convinced himself that the extra-peritoneal form is probably a common form of the disease, although he admits that the effusion is intra-peritoneal in many cases. Dr. Tuckwell has collected 41 cases where post-mortem examination was made. Of these the extravasation of blood was intra-peritoneal in 38 cases; an account which, however, only proves that the intra-peritoneal form is the more fatal, as previously observed. The opinion that hæmatocele may be extra-peritoneal as well as intra-peritoneal, is shared by MM. Huguier, Nonat, Robert, Becqueril, Verneuil and Prost; M. Nonat, after a careful study of this affection in La Pitié and elsewhere, states in his systematic work on the diseases of the uterus, that he believes the extra-peritoneal form is more frequent though less grave than the other, and he believes it possible to diagnose the two varieties and prescribe appropriate treatment for each. Be this as it may, it seems desirable to make the definition of hæmatocele sufficiently wide to embrace all the forms of tumor resulting from the extravasation of blood around the uterus, whether it be inside or outside the peritoneum, and without reference to the causes producing it, so long as these causes are connected with the generative organs. Certain varieties may be more frequently associated with the pregnant and puerperal states than with menstruation, but practically they are attended by the same train of symptoms and admit of little variation in treatment.

In studying the anatomical positions of hæmatocele it is necessary in the first instance to note concerning the intra-peritoneal variety that there are two forms which differ not in the causes or sources of hemorrhage, but in the abundance or rapidity of the bleeding from whatever source it comes. Thus if hemorrhage be abundant and rapid, no localized tumor is formed, but the blood spreads itself over a large surface of the peritoneum, and if the patient does not sink from loss of blood, death results speedily from the extensive inflammation produced. This has been called "non-encysted hæmatocele or extravasation." On the other hand, if blood be poured out in limited quantity and sufficiently slowly, it commonly drops down into the recto-uterine *cul-de-sac*, and there becomes encysted, being ultimately surrounded on all sides by lymphy adhesions. The way in which blood becomes encysted to form hæmatocele in the retro-uterine space is thus described by M. Voisin:—

"When blood escapes from the ovaries, the tubes, or the uterus, it falls naturally behind the broad ligaments into the retro-uterine peritoneal space, limited before by the broad ligaments and uterus, behind by the rectum and lateral folds of the peritoneum—on all sides by serous membrane. Above, the *cul-de-sac* is open, and communicates largely with the rest of the abdominal cavity. In some rare cases the blood is carried in part into the vesico-uterine space, but in a very small proportion compared with the mass extravasated behind the uterus. Hardly have some drops of blood penetrated into the serous cavity than it inflames. This inflammation results in speedily establishing adhesions between all the pelvic organs, or rather between their peritoneal coverings. The coils of intestine are pushed upwards by the extravasated fluid, or rise upwards by their own lightness. The collection of blood encysts rapidly, thanks to the energy of the inflammation of the serous membranes and the formation of cellular adhesions. The sides of the tumor are then limited, before by the broad ligaments, behind by the rectum and peritoneum, below by the recto-uterine *cul-de-sac;* above, by the coils of intestines which, by their adhesions to the fundus uteri, the broad ligaments, the ovaries, the tubes, the round ligaments, and the peritoneum which covers the lateral parts of the pelvis, form for the cyst a sort of resisting roof."

In the "extra-peritoneal variety," the blood is poured out into the meshes of the cellular tissue which surrounds the uterus and other organs in the pelvis. In these cases the tumor is much less constantly situated between the uterus and rectum, than in the variety last described, and it may, indeed, be formed in any part of the pelvis where rupture of a vessel has taken place, and where the cellular tissue is lax enough to permit separation of its layers. It divides its frequency between the posterior aspect of the uterus, and laterally between the folds of the broad ligaments. Here the vessels are most numerous, have the largest calibre, and being surrounded by looser tissue

[1] These statistics are not inserted in the third edition, and Dr. West there submits to the authority of M. Bernutz on this point.

than elsewhere, are more liable to unequal degrees of distension. If the extravasated blood be considerable in quantity and the tumor large, the peritoneum will be separated from the structures upon which it normally lies, and either pushed aside, or raised upwards towards the cavity of the abdomen. In both the intra- and extra-peritoneal forms, the position, shape, and dimensions of the swelling vary in accordance with the exact situation of the vascular rupture and the amount of blood effused.

From the results of clinical observation it is highly probable that small extravasations of blood frequently take place in certain subjects about the time of the catamenial periods, but inasmuch as the quantity effused is too sparing, to form a well defined swelling, so the symptoms, though the same kind, are commonly more obscure. When a distinct tumor is formed, it will occupy a space in the pelvis in proportion to its bulk, and may, if large enough, be felt through the abdominal walls cropping up out of the pelvis, or if smaller only by vaginal examination. The pelvic viscera are necessarily pressed upon and displaced in most cases where the swelling occupies the cavity of the pelvis proper and attains any considerable size. Commonly the uterus is pushed so far upwards and forwards that the cervix can with difficulty be reached above the pubes, while the tumor is found occupying a large space in the posterior half of the pelvis.

The *sources* of the hemorrhage which have been described, are several. Voisin considers only three, viz., congestion and hemorrhage from the vesicles of De Graaf during a menstrual period; reflux of blood from the uterus into the Fallopian tubes and peritoneum; and hemorrhage originating in the Fallopian tubes themselves. Bernutz discusses five sources or causes, and classes the varieties in accordance with the causes thus:—

1. Hæmatocele symptomatic of rupture of utero-tubar varices. 2. Hæmatocele symptomatic of blood exhalation from the pelvic peritoneum. 3. Hæmatocele symptomatic of rupture of the ovary or Fallopian tube. 4. Hæmatocele symptomatic of difficult menstrual exertion. 5. Hæmatocele symptomatic of excessive secretion from the genital organs—metrorrhagic hæmatocele.

The evidence concerning some of these sources of hemorrhage is indistinct and inconclusive, while the frequency of others is sustained by accumulated observation and testimony. The causes may be conveniently studied under the following heads.

1. There would seem to be no doubt that rupture of a vessel in some of the structures of the ovary is a frequent cause of pelvic hæmatocele. Physiological investigation has fully proved that at each ovular period which corresponds in the human female with the appearance of the menstrual discharge, one or more Graafian vesicles near the surface of the ovary become distended with crimson contents and at length rupture, and discharge themselves into the infundibular extremity of the Fallopian tube. A certain quantity of blood escapes at the time, but under normal conditions the amount is small. When, however, any antecedent morbid change has altered the structure of the ovary and increased the size of its bloodvessels, the blood effused may be much more considerable in quantity. Congestion and hypertrophy by enlarging the calibre of the vessels, induce a tendency to unusual hemorrhage at the periods of ovulation, and the same may be said of cystic disease of the ovary. It is by no means uncommon in the post-mortem room to find small collections of extravasated blood in the substance of the ovary, and occasionally ovarian cysts are met with filled with coagulated blood, which has been poured into their interior, from the rupture of some of the large vessels ramifying in the parietes of the cyst. Death has been known to result from intra-cystic hemorrhage of the form just mentioned. It can be readily understood how over-distension of a cyst or congeries of cysts in the ovary, more particularly if the effects of any accident or violence be superadded, might lead to rupture of the cyst-wall and extravasation of blood into the peritoneal sac. M. Voisin adduces several examples of hæmatocele produced in this way, and arrives at the conclusion that there is usually some pre-existing disease of the ovary which predisposes to laceration of the bloodvessels and consequent extravasation. M. Gallard proposes a modification of this theory of ovarian hemorrhage, and suggests that in some cases hæmatocele is due to the presence of an ovum which has missed the oviduct and dropped into the peritoneum.

2. The Fallopian tube—the mucous membrane of which contributes to the menstrual flux—would seem occasionally, when unusual excitement or congestion exists, to be capable of pouring out so large a quantity of blood from its free extremity, as to give rise to hæmatocele. In like manner, blood may, if retained in the uterine cavity by occlusion of the os, or from displacement of the womb, as in extreme retroflexion, be driven along the oviducts to the peritoneal cavity, or burst the tube and consequently form hæmatocele. Dr. Matthews Duncan has pointed out that obstruction or occlusion of the os uteri is not necessary to make blood secretion in the cavity travel along the

Fallopian tubes and so enter the peritoneum. He states that besides the tubes being periodically dilated to permit the passage of ova, they are sometimes in a continued state of dilatation and patency from pathological conditions. Under these circumstances even when the os uteri is sufficiently pervious, the mechanical arrangements of the viscera and the ærostatic mechanism of the abdomen walls, will drive fluid along the tubes and so explain the production of hæmatocele.

3. Puech, Voisin, and Bernutz have drawn attention to the rupture of a vessel in the utero-ovarian plexus lying between the folds of the broad ligaments as one occasional cause of hæmatocele. In certain patients the veins here, as well as in the lower extremities, and round the vulva and anus, are apt to become varicose. In this condition, their coats are thinned and weakened and prone to give way under increased pressure from muscular efforts or other causes. Probably an extra-peritoneal hæmatocele would be produced by such rupture, but M. Voisin states that in all cases of this kind which have been recorded, where laceration took place into the peritoneal cavity, the loss of blood has been so rapid and profuse, that no time has been allowed for it to become encysted, and immediate death has been the result.

4. M. Tardieu, M. Bernutz and others have described instances in which the source of bleeding was the general surface of the peritoneum affected by disease somewhat analogous to hemorrhagic pleurisy. This has received the name of "hemorrhagic pelvi-peritonitis." Virchow and Herber suggest the possibility of capillaries being formed in false membranes over the pelvic peritoneum, and being the source of bleeding in these cases. Professor Dolbeau who gives his adhesion to this theory asserts that an immense number of cases of retro-uterine hæmatocele are produced by pelvic peritonitis of a hemorrhagic form, and that this explains the less serious nature of some cases as compared with those having a tubal, ovarian, or varicose source.

5. A further source of internal hemorrhage giving rise to hæmatocele, which has been described, is a general hypersecretion of blood from all the genital surfaces, internal and external, to which M. Bernutz has given the name of "metrorrhagic hæmatocele." This pathological condition, which is not like the last form, the result of inflammatory action, is somewhat analogous to the hemorrhagic diathesis. The formation of hæmatocele internally is preceded and accompanied by excessive menstrual discharge from the uterus and vagina, and it is presumed that a simultaneous bursting forth of blood takes place, both from the mucous surface of the genital canals, and the peritoneum covering the outer surface of the uterus and its appendages. This class of cases has especially been noticed during the progress of the eruptive fevers, and a diminution in the amount of fibrine in the blood has been supposed to favor the hemorrhage. Scanzoni has related the case of a patient affected with measles, who died immediately after the commencement of menstruation, from hemorrhage which took place into the peritoneal cavity from the left Fallopian tube; and M. Bernutz has collected many examples under this head which he has classed in groups according to certain characteristics or differences. Belonging to this order are hæmatoceles characterized by some cachexia, or by anæmia and chlorosis, in which the blood is impoverished and thus more easily escapes from its containing vessels.

Although it is well established that hæmatocele takes place most frequently at or about the time of the catamenial period, and for the reasons previously stated is then the result of some derangement of the menstrual function, yet the affection occurs in some instances where the catamenia are absent and the function of spontaneous ovulation is suspended. During pregnancy and after delivery and abortion, extravasation of blood both into and outside the peritoneum may give rise to the formation of a pelvic blood swelling, having all the characters commonly observed in a typical hæmatocele. Examples of this kind have been recorded by Dr. West, M. Voisin, and M. Bernutz.

Morbid Appearances.—The reports of post-mortem examinations in cases of non-encysted blood extravasation into the peritoneum, are proportionally more numerous than those of encysted hæmatocele, inasmuch as the former much more frequently ends fatally. (On these portions of the subject we quote largely from M. Voisin.) In the non-encysted form it is generally found after death that the skin of the body is devoid of color, and the belly tumid, more particularly in the region of the hypogastrium. Black fluid blood may escape in considerable quantity when the abdomen is laid open. The intestines are distended with gas, and pushed up above the mass of blood contained in the pelvic cavity. The abdominal organs are often covered with clots, the intestines stained of a bluish color, and in one recorded instance the mesentery was infiltrated with blood. The amount of blood, fluid and coagulated, contained in the pelvis and abdomen has repeatedly been found to be as much as four pounds. In twenty cases quoted by M. Voisin, the source of hemorrhage was traced in sixteen to some distinct lesion.

In six cases the hemorrhage came from the ovary; in four from the rupture of an ovarian varix, in two from the cavity of the uterus, and in four from the Fallopian tube. In the remaining four no distinct lesion could be found, and it was supposed that the hemorrhage resulted from an exhalation or oozing of the blood from the surface of the peritoneum.

In the few autopsies which have been made of women who have died with limited or encysted hæmatocele, no great tumefaction of the abdomen was met with. Commonly the general surface of the peritoneum was healthy, except that occasionally adhesions were remarked between the intestines. If any of the adhesions forming the boundaries of the cyst had been torn so as to allow the cyst contents to escape, the usual products of inflammation were found—redness and vascularity, lymphy exudations, purulent serum with albuminous flakes. To take a typical example of the intra-peritoneal form from M. Voisin: On a level with the brim of the pelvis, the viscera were seen to be united together, forming the roof of the cyst. The bladder was elevated above the pubes; the uterus close behind it, somewhat increased in size, and rotated upon its axis into a position different from the usual one. Behind, adhesions united the posterior and superior aspect of the uterus to the rectum, a portion of the sigmoid flexure of the colon and several coils of small intestine, the two broad ligaments and the posterior half of the circumference of the brim of the pelvis. A roof was thus formed over the posterior half of the pelvic excavation. On laying open the cyst, the thickness of the walls was found to vary with the amount of fibrinous exudation at the point of incision. The cyst cavity was divided into a number of compartments by cellular bands, but communications existed between the various loculi. All the pelvic organs were more or less fixed, the ovaries displaced, and completely lost among the inflammatory products. In an opening that had been effected previous to the decease of the patient, traces of ulceration were found, and the fistula between the aperture and cyst was sinuous and irregular.

The contents of the cavity sometimes consist of clots more or less changed in color and arrangement; sometimes of a variable quantity of black fluid, grayish at certain points, and sometimes like an admixture of soot and water. At times the fluid has a tarry, syrupy consistence, and if suppurative action has taken place, there is an admixture of pus. These products have been observed also when the cyst has been evacuated during life by a trocar. Under the microscope the contents have been found to be composed of blood globules completely bereft of color, and so altered in shape as to be scarcely recognizable. Besides these are fat globules, amorphous particles of hæmatoidine, various crystals, and other materials resulting from the transformation of effused blood. In most cases of encysted hæmatocele, the displacement and confusion of parts seem to have been so great in consequence of the effused blood and subsequent inflammation, that the determination of the source of hemorrhage was anything but satisfactory. From various data, however, the blood seems to have come from rupture in an ovary previously diseased, in the largest number of instances.

CAUSES.—The causes are predisposing and exciting. As might be expected, hæmatocele occurs at the period of greatest sexual vigor in women; and from an extended series of observations, collected by Dr. Tuckwell, it has been found that between twenty and thirty years of age is the period of its most frequent occurrence. Marriage seems to have little influence in its production. Some deviation from normal conditions in the function of menstruation has been noted by all observers, as preceding the development of hæmatocele. Thus M. Voisin remarked that the larger number of patients affected with hæmatocele had habitually an over-abundant menstrual flow; the color of the discharge was bright, and clots were frequent. These signs he considers as indicating a plethoric condition of the system, and infers that a recurring over-distension of the pelvic bloodvessels in plethoric patients favors the formation of hæmatocele. On the other hand, hæmatocele undoubtedly occurs from time to time in feeble and chlorotic patients, whose menstruation has been supended it may be for months, and who are the subjects of amenorrhœa. In these cases, the rupture of an internal bloodvessel does not necessarily take place from any physical obstruction to the catamenial flow by the natural passages, but from constitutional conditions which have impaired the quality of the blood and weakened the integrity of its containing vessels.

Pathologists are familiar with attacks of hemorrhage from mucous canals, and into serous cavities, during the progress of eruptive fevers, in purpura, and other cachectic conditions, and similar morbid changes in the blood seem to be predisposing causes of hæmatocele.

In most patients whose menstrual history previous to an attack has been investigated, it has been ascertained that the recurrence of the periods was regular, and the discharge was frequently profuse and too prolonged, but whether abundant or scanty, it was in the majority of cases attended with pain. In a few of these

the pain may have been due to mechanical obstruction, caused by a contracted cervix or a displaced fundus, but in most instances the suffering was but the expression of faulty performance of function on the part of the womb, associated with an over-distension of its blood vessels. Among the other predisposing causes, a weak and varicose condition of the veins in the pelvis and lower extremities deserves a place. Women who have varicose veins of the lower limbs, and are liable to hæmorrhoids, to venous swelling of the vulva, and to a weighty, spongy condition of the uterus, often menstruate most copiously and painfully. These patients have frequently been observed to be prone to hæmatocele, when an exciting cause has been applied during or near the time of a menstrual period.

The exciting causes enumerated are, sudden suppression of the catamenial flow, over fatigue, violent straining at stool, cold, intense mental emotion, premature exertion after abortion, and violence producing injury during menstruation. In a considerable number of Voisin's cases the immediate cause was traced to coitus which had taken place either during the catamenial flow or very shortly after its termination, and the pain began during the sexual act.

Symptoms and Progress. — The symptoms of non-encysted extravasations and of cystic hæmatoceles differ in some important particulars. In the former, the commencement of the disease is sudden, perhaps coming on in the midst of apparently good health, and the suddenness and intensity of the attack, it has been suggested, may possibly lead to a suspicion of poisoning. It is commonly coincident with a menstrual period. The initiatory symptoms are in all cases those of severe shock with intense abdominal pain, similar to that produced by an attack of acute peritonitis, the patient being thrown into the most violent distress and agitation. The symptoms indeed bear a very strong resemblance to those produced by perforation of the stomach or bowel, with extravasation of their contents into the peritoneum; but in addition there is marked anæmia produced by sudden and profuse loss of blood. The belly becomes tender and hard, as well as dull on percussion. Hiccup and vomiting are sometimes present; the temperature of the skin is low, and its surface pale and blanched. Syncope or complete collapse speedily follows, with a small and almost imperceptible pulse, and death generally ensues in less than twelve hours.

The incipient symptoms of encysted hæmatocele are to some extent the same in character as in the non-encysted, but those common to both are somewhat less in severity. The gravity of the attack varies in accordance with the suddenness and amount of blood extravasated, and the general condition of the patient. It is highly probable also that the severity of the attack will vary with the seat of the effused blood, being more acute and threatening when the blood is poured into the peritoneal cavity, less so when the effusion is into the cellular tissue, for the double reason that less disturbance is provoked when blood is extravasated beneath the peritoneum than on its free surface, and that effusion is likely to be slower and more gradual into the cellular tissue.

The illness, as in the other form, is generally preceded by some notable derangement in the menstrual function, and commonly dates from a catamenial period, which has perhaps been attended with more than usual pain; the discharge being inordinately profuse, and prolonged beyond the normal limits. Then immediately following some effort, or coitus, comes sudden and intense pain in the pelvis, often compared to the throes of parturition, but increased by the least pressure or movement. If the blood effused be considerable in quantity, and particularly if it has escaped into the peritoneum, there is fainting almost amounting to syncope, and this conjoined with the indications of local peritonitis. In several instances it has been noticed that the patient, having been exposed to cold or undue exertion or injury during menstruation, or immediately after it, has awoke in the night with a sense of exhaustion and faintness, and begged to be supplied with food. This preliminary exhaustion has speedily been succeeded by abdominal pain and other characteristic symptoms. The pain is more or less continuous with recurring exacerbations, or it is paroxysmal, and a weight about the anus is often complained of, with frequent desire to go to stool. Pain and difficulty are frequently experienced in evacuating the bowels, with tenesmus, and quantities of mucus passed, possibly mixed with blood, indicate much irritation of the intestinal mucous membrane. Painful micturition is not uncommonly complained of, and partial retention of urine may greatly add to the discomfort of the patient, while, if not detected, it may lead to complications in diagnosis and mask the real ailment. To these symptoms Voisin adds, a rapidly produced and marked pallor of the skin, which assumes a dull whiteness, and is not unlike that which accompanies the cancerous cachexia. Very speedily acute febrile symptoms supervene with rapid pulse, increased temperature, and loaded urine. The patient prefers to lie upon

her back with the thighs flexed on the abdomen. There is often considerable distension of the intestines by flatus, and all the ordinary signs of limited peritonitis are developed as the result of the sanguineous effusion.

If the hæmatocele be large, a tumor is speedily discovered which can be felt through the abdominal walls above the pubes, or in the direction of the iliac fossa on either side. Dr. West says he has detected the swelling within 48 hours after the first symptom, and in many cases it may probably be detected earlier. It is commonly only slightly tender to pressure, but in some instances careful examination is rendered impossible for a time by the extreme sensitiveness. It will be best examined as the patient lies upon her back, because then external and internal manipulation can be combined, and the most accurate estimate formed of the size, consistence, and relations of the tumor. A careful exploration by the rectum should rarely be omitted, as in this way the position of the swelling as it lies between the vagina and bowel is at once ascertained.

The physical characters of the tumor are dulness on percussion, immobility, or very partial mobility, more or less irregularity of outline, and generally some tenderness on pressure. Soon after its formation, the swelling is elastic and indistinctly fluctuating; later, it is irregular and of unequal density, and then closely simulates the results of pelvic cellulitis. When of any considerable size, and retro-uterine, it is found on vaginal examination to occupy the posterior half or more of the true pelvis, elevating and pushing forward the cervix uteri above the pubes, stretching and distending the posterior wall of the vagina, and compressing the rectum behind it, into the concavity of the sacrum.

Ordinarily, it seems fused with and firmly united to the uterus, but occasionally the uterus may be moved in some degree independently of the swelling, both with the finger and the uterine sound. Dr. M. Duncan noticed that the length of the uterine cavity was much increased whenever the hæmatocele was large, and it decreased with the contraction of the blood sac. Frequently it has been observed of such dimensions as almost to fill the true pelvis, and to distend and push down the back wall of the vagina so far that it almost reached the vulva. When the swelling projects very low in the pelvis, it has been supposed that it must necessarily be due to extravasation into the cellular tissue, because the peritoneal sac has a higher level; but when it is recollected that the peritoneum is often prolonged far down the posterior wall of the vagina, and that the lower boundary of the *cul de sac* almost reaches to the floor of the pelvis, this deduction is found to be of uncertain value. A source of fallacy concerning the very low position of the tumor exists in some cases of hæmatocele, as well as in pelvic cellulitis. This consists in the production of a large amount of œdema in the lower part of the recto-vaginal septum. This is sometimes so considerable as to form a distinct rounded swelling within the vagina. When the position of the tumor is other than retro-uterine, it will displace the pelvic organs in accordance with its dimensions and relative position. On more than one occasion it has been remarked that it produced complete retroversion of the uterus. Graily Hewitt, in his "Diseases of Women," gives two illustrations of position, in outline, of the extra-peritoneal form. In one, the hæmatocele tumor rose as high as the crest of the ilium on the right side, and dipped half way down the pelvic canal inferiorly. In a second the extravasated blood is represented as surrounding the bladder, uterus, and rectum in every direction, and the tumor so formed reaches as high as the umbilicus above, and to within a short distance of the perineum below. These, however, are extreme forms. Occasionally the quantity of blood effused is so limited that no well-defined tumor is formed notwithstanding the presence of characteristic, general symptoms. Dr. West, who with Dr. Matthews Duncan has noticed the absence of distinct tumor in some cases where the other symptoms were unequivocal, believes that in these instances the effusion was extensive, and either not circumscribed enough to form a defined tumor, or at any rate not low enough in the pelvis to produce bulging of the vagina.

This explanation obviously will not apply to those cases in which the general symptoms, though the same in kind, are slight in degree, and it seems more reasonable to suppose that the effusion has been so scanty as to produce but little local tumefaction.

It has been observed, but rarely, that more than one hæmatic tumor was present at the same time; one being seated in the iliac region and felt by external examination, the other being situated deeply in the pelvis and reached only by vaginal exploration. It is of course possible that these apparently separate tumors may have been the extreme poles of one elongated tumor. Some authors have enumerated among the symptoms an undue pulsation of the arteries in the vagina and cervix uteri as observable during the progress of hæmatocele, but this symptom is not always present, and

in Dr. Madge's case,[1] both internal throbbing and the pain in defecation previously mentioned were notably absent.

The progress of the disease is variable, and so also is the development of the tumor. Sometimes the attack sets in with great violence, and the progress is rapid. In the majority of cases, indeed, the tumor attains its largest size in a very short time from the commencement. In a few hours, or at most, a few days after the first symptoms, the pelvic mass may attain the size of a child's head, or of a gravid uterus at six months, and it then rarely increases in size afterwards. Other instances present themselves in which the symptoms are less acute. Blood seems to be poured out in but small quantity and in progressive quantities at certain intervals, creeping on, as it were —the increase in swelling coinciding with the monthly periods. Nevertheless a careful study of well-marked cases has shown that very speedily after the swelling has reached its maximum development, the natural tendency is to decrease in size. The tumor gradually becomes harder to the touch, of unequal density, and the sensation of fluctuation gradually disappears. These alterations in consistence arise from the changes which take place in the extravasated fluid. The serum of the blood is quickly absorbed, while the coagulum remains for a much longer period, some portion of it being found occasionally even months after the date of the attack. When the hæmatocele has attained its maximum size and become stationary, it has been noted by several writers as a curious fact that the recurrence of the menstrual period exercises no influence in increasing its dimensions. On the contrary, when menstruation is re-established, each period is marked by a notable diminution in volume, and instead of undergoing a gradual and continuous decrease, the swelling recedes by successive steps, which correspond to catamenial periods. This fact is especially dwelt upon by M. Voisin and Professor Dolbeau. With the invasion of the malady the catamenial flow, if present at the time, may be checked and only return after an uncertain interval. Very commonly, however, instead of being arrested, it becomes so profuse as to be a marked feature in the case, and when restrained within moderate limits, it often persists for weeks as a dribbling hemorrhage, which is a further drain on the strength of the patient.

After a time, in the natural course of events, when no surgical procedure is undertaken, and judicious palliative measures have been adopted, the febrile symptoms gradually subside, the pain decreases, and subsequently the patient experiences only great weakness; a sense of weight in the pelvis, bearing down; some difficulty in micturition and defecation; and pain and discomfort in attempting to walk or to assume the sitting posture. If one side of the pelvis only is occupied by the tumor, there may be increased pain on moving the leg of the affected side. These symptoms are variable, but as a rule when no interference is practised, recovery takes place slowly and by resolution, the blood being gradually absorbed and the damage done being ultimately repaired. The average period, within which cure takes place in this way, is found to be about four months. Small collections of blood may under favorable circumstances be removed by absorption in six weeks; while if the tumor be large, or recovery has been interrupted by any cause, eight, twelve, or more months may elapse before all traces of induration in the pelvis have disappeared. When recovery does not take place by resolution, the fluid contained in the hæmatocele commonly makes its escape externally through one of the pelvic canals. There is a divergence of opinion as to whether suppuration of the cyst always precedes its evacuation, but the failure to detect well-formed pus in any considerable quantity in the discharges, in most of the instances which have terminated in this way, evidently points to the conclusion that there has been no general suppuration of the cavity, but that simple ulceration of the walls takes place resulting in perforation and subsequent evacuation. When such evacuation does take place, a reaccession of the original symptoms commonly occurs, and is then followed by the discharge of a quantity of fluid and semi-solid material which has been compared in appearance to currant jelly, and in odor to that of decaying flowers. In twenty-seven instances cited by Voisin, six emptied themselves by the rectum, three by the vagina, and four burst into the cavity of the peritoneum. This last mode of termination, whether produced by suppuration or not, is by far the most serious, inasmuch as it is uniformly followed by general peritonitis and death. If suppuration should take place in the hæmatic cyst, it is generally associated with a fresh accession of pain—rigors and fever, followed by profuse perspirations, as when suppuration is established in other parts. The danger of a rupture into the peritoneal cavity is then considerably increased, and hence the necessity of early artificial opening when once suppuration is established beyond doubt, and the symptoms are threatening. Dr. M. Duncan has dwelt on the importance of recognizing the existence of fluid in the lowest part of the sac in

[1] Obst. Trans. vol. 3.

hæmatocele of some standing, as indicative of previous inflammatory action and the presence of pus. More recently he has modified this opinion, and has pointed out that the mere presence of fluctuation, if it has not been preceded by the general and local signs of suppuration, is not sufficiently trustworthy, and may lead to an erroneous conclusion. The inflammation of a hæmatocele, particularly if it suppurates in such a way and points in such direction that it cannot readily be opened by the knife, is apt to protract the recovery of the patient indefinitely. At times the formation of purulent matter takes place so insidiously that the signs are too indefinite to act upon, and the first distinct proof of its existence is the discharge of pus and broken-down coagula or coffee-ground materials by the rectum. As in pelvic abscess, this may lead to chronic irritative diarrhœa and dysentery, the prolongation of which, added to the profuse purulent discharge and accompanying hectic, may exhaust the strength of the patient and lead to a fatal result. An example of this kind is given by Dr. McClintock in his "Diseases of Women." In Dr. Madge's case (Obstet. Trans.), in addition to suppuration and exhausting discharges, phlegmasia dolens set in as a further complication, and the patient died from extreme exhaustion.

Lastly, it may be mentioned that intercurrent peritonitis may at any time supervene during the progress of the affection, and this apparently apart from rupture of the cyst. Commonly, the inflammation of the peritoneum which is lighted up at first in all cases when blood is poured into the peritoneal sac, gradually subsides after the effusion is sealed up by surrounding adhesions, and in these instances the patient has a fair prospect of recovery. If the peritonitis becomes more general, this entails further peril, and at no time during the continuance of the hæmatocele is there immunity from its possible reappearance. Voisin has observed this mode of fatal termination in one case as late as three months, and in another at the end of four months from the production of the hæmatocele.

DIAGNOSIS.—In a typical case of pelvic hæmatocele the diagnosis is commonly made without difficulty. The occurrence of the attack at or about the date of a catamenial period, the menstrual function having previously been notably deranged; the suddenness of the invasion and the production of general anæmia; the rapid formation of the pelvic tumor, accompanied first with symptoms of shock, and later with those of limited peritonitis, are the points chiefly to be dwelt upon as the cardinal elements in forming an opinion; and if the case has been under observation from the commencement, the real nature of the affection is not likely to be overlooked. When, however, a case is seen for the first time in its chronic stage, the formation of a correct opinion is often most difficult; and even with all the aid of a succinct history, which is not always forthcoming, it may readily be mistaken for other morbid conditions found in the pelvis.

1. The affection which of all others bears the closest resemblance to pelvic hæmatocele in its chronic stages, and which is most likely to be mistaken for it, is, peri-uterine inflammation, pelvic cellulitis, or peritonitis, or pelvic abscess, as it has been variously named by different authors. The inflammatory affection is more frequent than hæmatocele, but so many symptoms are common to both, that the greatest care is often needed to form a correct diagnosis, and in some cases it is doubtful if the nicest discrimination will prevent the one from being mistaken for the other. The chief points of difference in the history of the two affections are that pelvic inflammation and abscess are more frequently consecutive to abortion and delivery, and when not so, have often some relation to inflammation previously existing in the uterus or ovaries. Hæmatocele, again, is more constantly connected with some accidents of menstruation. Pelvic cellulitis or peritonitis has no such common coincident menorrhagia, and does not develop its greatest intensity suddenly; the skin does not rapidly become pale from anæmia, as in the larger hæmatic tumors; and the swelling, if watched throughout its course, is more likely to begin in the lateral and anterior parts of the pelvis; it is hard at first, comparatively slow in formation, and fixes the uterus to the walls of the pelvis; later, if suppuration occurs, it then becomes soft and fluctuating. In hæmatocele, on the other hand, the tumefaction is more frequently behind the uterus, it is soft in its early stages, and grows harder as time passes, only beginning to fluctuate again if the cyst becomes inflamed and suppurates. A further point of difference to be noted is that in hæmatocele, if the swelling be at all considerable, it has a tendency to roundness in form, with hard inflammatory deposits about its margin; and it displaces and distorts the uterus from its natural position. In cellulitis and pelvi-peritonitis the fibrinous deposit is infiltrated through the pelvic tissues affected, fixing the uterus so that it cannot be elevated or depressed, instead of displacing it. It often gives the impression which might be produced by soft plaster-of-Paris poured into the pelvis and hardened there, fixing the viscera to the osseous boundaries of the pelvis. The constitu-

tional symptoms also follow an inverse ratio in the two affections, febrile disturbance distinctly *preceding* the formation of tumor in the inflammatory affection, *following* its formation in hæmatocele.

When the amount of extravasated blood is small, it may be impossible, either in the early or later stages, to discriminate between the slight thickening and induration produced by this cause in the pelvic tissues and that arising from primary inflammation. Equally when a case does not come under observation until suppuration has occurred, and no distinct history can be elicited, it may be impossible to determine whether the abscess is due to primary phlegmonous inflammation or is the secondary product of a suppurating hæmatocele. Fortunately in the two cases the treatment is practically the same, and the patient suffers no disadvantage from a failure to decide concerning these perplexing differences.

2. The diagnosis between hæmatocele and ovaritis is stated by M. Voisin and others to be very difficult, and yet one would fancy that practitioners familiar with the varying phases of inflammation of the ovary were not likely to commit an error of diagnosis between the two. The limitation of the pain and swelling in the earlier stages to the locality of one or other ovary, with the general symptoms, would be a sufficient guide to the nature of the affection in the larger number of cases. When a considerable swelling has formed as a consequence of a longer and more intense attack of ovaritis which has extended to surrounding parts, it may be needful to remark that there has been no sudden invasion or rapid formation of a tumor, as in hæmatocele; no sudden anæmia, perhaps no coincident menorrhagia; and the symptoms gradually increase in severity from the commencement, while in hæmatocele the most severe and distressing symptoms are developed from the first, and as time passes, undergo gradual amelioration.

3. The various forms of ovarian tumor of limited size are in general to be distinguished by their lateral position, slower growth, mobility, circumscribed form, and absence of urgent symptoms from the commencement. If an ovarian cyst, while small, has descended into the retro-uterine *cul-de-sac* and formed adhesions there, the points of difference indicated become less useful guides, and if perchance the cyst inflames and suppurates in this position, the diagnosis may be by no means easy. Ovarian tumors indeed sometimes inflame while lying behind the uterus, and without proceeding to suppuration throw out irregular lymphy deposits which mask the circumscribed form of the original tumor, and with softened centre and harder circumference may simulate the physical characters of hæmatocele. The only way of discriminating in these perplexing cases is to study carefully the previous history and watch the further progress. It is useful to bear in mind, as pointed out by Dr. McClintock, that it is extremely rare for an ovarian cyst to sink as low in the pouch of Douglas as the blood gravitating downwards in the peritoneal cavity, when an intra-peritoneal hæmatocele is formed. This indication, however, loses much of its value from the fact that when inflammation of any kind occurs in the neighborhood of the pouch of Douglas, there is often so much œdema of the recto-vaginal septum that it closely resembles fluctuation there, and often forms a considerable projection of the posterior wall of the vagina. In the lapse of time, after the inflammatory action has subsided, the nature of the disease is made clear by observing that, as the serous and lymphy effusion is absorbed, the central tumor remains, and if this be fluctuating and unattended by hectic symptoms, it is pretty certain to be ovarian. In doubtful cases of this kind, where it is of importance to decide speedily the character of a fluctuating swelling in this locality, recourse may be had to an exploring needle or fine trocar, as recommended by Sir Jas. Simpson and Professor Braun.

A very difficult point in diagnosis may arise, between the formation of hæmatocele and the sudden and rapid enlargement of an ovarian cyst by hemorrhage into its cavity. In both there would be the general indications of internal hemorrhage, but in the latter case there would probably be the history of a pre-existing ovarian tumor, and the perfect regularity and smoothness of the swelling, with its possible mobility, would favor a correct inference as to its character.

Encephaloid tumors, which, from their consistence and position, may be mistaken for hæmatocele, are to be distinguished by their history and the presence or absence of the cancerous cachexia. It is important, however, to bear in mind that the appearance of a patient suffering from an extensive hæmatocele is very like that of a cancerous patient, and if the aspect and color of the patient be too implicitly relied upon, it may lead to serious error.

4. Retroflexion and retroversion of the uterus in the gravid and unimpregnated conditions — inasmuch as they may be produced suddenly from violent efforts or straining, and lead sometimes to retention of urine and other urgent symptoms coincident with the formation of a retro-uterine tumor,—may be mistaken for hæmatocele. In the unimpregnated condition, the use of the uterine sound, showing the direction of the womb cavity, would at

once solve the question. When menstruation has been suspended and there are other signs of pregnancy, the sound cannot of course be employed, but there will ordinarily be no great difficulty in arriving at a correct conclusion if the general course of the symptoms be carefully studied, and if due care be exercised in observing the circumscribed form of the swelling, the absence of adhesions on its borders; its relation to the cervix uteri, and its partial mobility and in some cases perhaps its capability of being replaced by pressure with the finger through the vagina or rectum. The value of any signs connected with the mobility of the swelling is necessarily vitiated, both in the pregnant and non-gravid condition, when the fundus is bound in a retroflexed position by old adhesions. Wherever the hæmatocele is of any considerable size it may be felt above the pubes, while a retroflexion can only be reached by internal examination.

5. Fibroid tumors of the uterus are to be diagnosticated by their history of slow, commonly painless growth, by their density, and relations, and their attachments to the uterus. In their commonest forms they bear no sort of resemblance to hæmatocele either in their mode of development or physical characters, and yet the disastrous experience of such experts as M. Malgaigne and Professor Stoltz plainly shows that some of the complicated forms of fibroid may be mistaken for hæmatic tumor. As mentioned in the earlier pages of this memoir, M. Malgaigne proceeded to remove by operation a supposed fibroid tumor of the uterus which proved to be a retro-uterine hæmatocele, and Stoltz fell into the same error, both cases ending fatally. In truth, the difficulty of determining in some cases whether a pelvic tumor is solid or has fluid contents is almost insurmountable without the aid of an exploring needle. A tightly distended cyst may feel so hard and dense as to simulate a solid growth, and on the other hand a fibroid tumor may possess such softness in its component elements, particularly if previously inflamed, that it is impossible to distinguish by the unaided touch between the two. When it is added that both fibroid tumor and hæmatocele are commonly attended by menorrhagia, which makes another point of resemblance, it will be obvious that no serious operation should be undertaken in this class of cases without previously clearing up any doubts which remain, by the exploring needle.

6. Fecal accumulations in the lower bowel are to be distinguished from hæmatocele by their plastic character, *i. e.*, they may ordinarily be indented by pressure through the vaginal wall. If harder, a careful digital exploration by the rectum will reveal the true nature of the swelling.

7. Lastly, some of the forms of extra-uterine gestation bear so close an analogy to pelvic hæmatocele, or general blood extravasation into the peritoneum, that even the most experienced observer may be unable to decide between the two. MM. Robert and Huguier mistook a tumor, which turned out to be an extra-uterine fœtation and occupied a considerable space in the pelvis and abdomen, for a pelvic hæmatocele. The absence of urgent symptoms in the commencement, and the presence of the usual signs of pregnancy, are the chief guides in discriminating between the two conditions. A still greater difficulty presents itself, however, when an early extra-uterine fœtation bursts into the cavity of the peritoneum, as ordinarily takes place when the ovum is developed in the Fallopian tube. In these instances the actual symptoms are absolutely the same as in intra-peritoneal pelvic hæmatocele, and the same pathological result is brought about, viz., the sudden escape of a quantity of blood into the peritoneum. Unfortunately the abundance of the sanguineous effusion in these cases gives no time or opportunity for its limitation by adhesions, and commonly the patient speedily dies from shock or peritonitis. There is nevertheless reason to believe that death does not always ensue in these instances, but that the extravasated blood and ovum become surrounded occasionally by adhesions after the manner of encysted hæmatoceles, and thus recovery takes place. In all cases it may assist in the formation of a correct appreciation of the facts, to recollect that even in extra-uterine pregnancies there is ordinary suspension of the catamenia for one or more periods, symptomatic changes in the mammæ, alterations in the cervix and body of the uterus, and sympathetic disturbance in other organs. Possibly, before the sudden invasion of the illness, a swelling may have been detected in process of development on the lateral margin of the uterus.

The PROGNOSIS is always more or less an anxious one. When vascular rupture has taken place into the pelvis, it is impossible to foresee to what extent the hemorrhage may extend, or when once checked what amount of exertion and how slight a movement may bring a renewal of such extravasation as may prove fatal. The tendency to aggravation at the catamenial periods, and the liability to low forms of peritonitis creeping on in patients apparently not in immediate peril, or even where the cyst is contracting and convalescence seems progressing, are additional sources of anxiety. To

these may be added the feebleness and exhaustion sometimes produced when the cyst suppurates and discharges through the bowel or vagina, and the not infrequent supervention of general blood-poisoning from absorption of morbific materials into the general system. With these detractions, the prognosis may as a rule be stated to be favorable. In the larger number of cases hæmatocele is not fatal, and by judicious management an untoward result may often be avoided, even when the symptoms are severe. Dr. F. Weber, of Berlin, one of the most recent writers on the subject, considers the prognosis very favorable. Of twenty-three cases observed by him, none were fatal—a result he ascribes to his method of treatment—ice bladder—perchloride of iron internally, and *avoidance of puncture*. In three of his cases, the broken-up extravasation burst through the rectum.

The TREATMENT may be considered as prophylactic and therapeutic.

Although it may be impossible to foresee an attack of internal hemorrhage forming hæmatocele, yet since patients suffering from certain derangements or forms of weakness are found by experience to be the most frequent subjects of hæmatocele, they should, when possible, be guarded by special precautions. Thus, women who suffer from dysmenorrhœa, particularly the obstructive forms, where mechanical hindrance exists to the escape of the catamenial discharge, constitute a large proportion of those affected, and these patients should be warned to be at rest during the continuance of the menstrual period, and in the intervals be submitted, if practicable, to such treatment as will remedy the painful and difficult menstruation. Again, women with varicose veins of the lower extremities, of the vulva or rectum, and who menstruate very profusely as well as painfully, should especially avoid all the exciting causes which are known to provoke hæmatocele. Such persons should avoid travelling, violent exertion, or exposure to cold, during the continuance of the catamenia, and sexual intercourse should be interdicted altogether near the menstrual period, and should at all times be practised moderately and without violence.

The therapeutic management must necessarily be modified by the *stage* of the affection which the medical man is called upon to treat. In the stage of shock or depression resulting from the first sudden blow inflicted by the effusion of blood, it is needful to bear in mind the pathological cause, and while palliating the general symptoms of shock, to try and limit the extravasation as much as possible. Non-encysted extravasations are as a rule so speedily and certainly fatal, that probably little can be done to avert a fatal issue; as, however, there are no means of accurately ascertaining the extent of the effusion, and consequently of judging of the probability of its becoming encysted, it behooves the practitioner, when the first symptoms of internal hemorrhage present themselves, to adopt such measures as are likely to stay the flow of blood, promote its coagulation, and avert the more disastrous consequences. The indications therefore are *not* to apply hot poultices or fomentations to relieve the abdominal pain, but cold compresses or bladders of pounded ice over the hypogastrium, to arrest internal hemorrhage. The patient should keep the horizontal posture absolutely, and avoid every movement of the body and all mental emotion which may disturb or excite the general circulation. Further aid may also be afforded by the use of sinapisms to the upper extremities, and a full dose of opium will have the double effect of calming the pain and lessening the depressing effects of the loss of blood. Some French authors recommend that in this stage blood should be taken once or twice from the arm to produce a derivative effect on the pelvic vessels and depress the systemic circulation, thus lessening the pressure on the internal bleeding points. M. Aran, in cases where the constitutional condition of the patient will permit, applies twenty to thirty leeches over the abdomen on the first day; fifteen to twenty on the second, and twelve to fifteen on the third day, if feebleness is not too great. The strength is supported by nutritious diet during the depletion, and the leeching is followed up by blisters and counter-irritation to the abdomen as soon as possible. M. Aran speaks strongly concerning the favorable issue and short duration of cases treated by this method. Neither general nor local depletion at this stage have, however, met with much favor in Great Britain. The diet should be simple, unstimulating, only enough to prevent the exhaustion of the patient, and all drinks should be taken cool or cold. Brandy or other stimulants should only be given when there is great prostration or collapse, lest they quicken the circulation and thus favor a larger loss of blood. Various astringents and hæmostatics may be administered if this be thought desirable. Sulphuric acid, tannin or gallic acid, acetate of lead, or perchloride of iron, may be combined with opium. When the alarming symptoms of the first stage or shock have subsided, it may be needful to calm the feverish reaction which commonly follows, and to combat the indications of local peritonitis which remain. To further this object, repeated doses of opium or some other sedative and narcotic should be administered by the mouth

or rectum; the patient should be absolutely at rest, the bowels kept quiet, and in the more critical cases the urine should be drawn off with a catheter, rather than allow the patient to make the least exertion. If the signs of local peritonitis are very severe, and the patient's strength will bear it, the application of a few leeches to the hypogastrium or iliac region may be recommended with advantage. Even in this stage, warm local applications should be used with caution, as they are apt to promote a fresh access of hemorrhage, especially in the intraperitoneal form, and favor the breaking down of the yet young lymph adhesions.

Opinions differ considerably concerning the propriety of surgical interference after the more acute symptoms have passed. Some authorities recommend puncture and evacuation in those instances where a distinct tumor is formed, which projects prominently down into the pelvis, and gives indications more or less distinct of fluctuation. Others counsel non-interference; and others again pursue an eclectic method and prefer evacuation by surgical means only when the symptoms are urgent enough to call for it.

It appears that at one time M. Nélaton employed the method of puncture and evacuation in all cases indiscriminately. In several instances where puncture was practised, his patients were attacked with purulent infection and died. This led to a modification of treatment, and artificial evacuation was resorted to only when the symptoms were urgent. According to M. Nélaton's later teaching, surgical interference is only warrantable when such symptoms are present as lead the practitioner to fear that rupture of the adhesions forming the parietes of the cyst will take place, and lead to subsequent extravasation of its contents into the general peritoneal cavity. Thus, where a hæmatocele of considerable size already exists, and appears to be increasing in size, being attended by constant and violent pain, he concludes that secondary inflammation is going on in the cavity, and that unless an opening be effected to lessen the tension, there is every probability that laceration of the cyst-walls will take place, and a general and fatal peritonitis be the result. M. Nélaton would not operate merely to expedite the recovery of the patient if there were no threatenings of immediate peril. The statistics collected by M. Voisin and published in his monograph are decidedly adverse to the propriety of artificial evacuation as a general plan of treatment, and lead him to prefer an expectant method, unless the case is attended with exceptional and threatening symptoms. Thus out of 20 cases where surgical interference was resorted to, 15 recovered and 5 died. In contrast with this, out of 27 cases treated by the expectant method, 22 recovered and 5 died. Deducting from the last class 2 deaths, in which hæmatocele was apparently not the immediate cause of death, the mortality was reduced to 1 in 9 when no operation was performed, while in cases where an artificial opening was made, the mortality was 1 in 4. Great as this difference may seem, it cannot be taken as overwhelming evidence in favor of leaving all cases indiscriminately to the curative powers of nature. M. Voisin's statistics are too limited for founding a sound practical conclusion, and there are sources of fallacy in them which do not lie immediately on the surface. The force of these objections is illustrated by comparing the results of a large number of cases tabulated by Dr. West in his Lecture on Hæmatocele. Of 55 cases treated on the expectant plan, 43 recovered and 12 died; while of 48 cases in which surgical interference was had recourse to, 40 recovered and 8 died. It deserves, moreover, to be pointed out as probable, that some of M. Voisin's cases treated by puncture, and which terminated fatally, were instances of the worst form of the disease, and that an opening was deemed necessary on account of the severity of the symptoms, not because it was deemed the best method as a general plan of treatment.

Recently, Dr. Meadows has published a paper in the thirteenth volume of the "Obstetrical Transactions," in which he boldly advocates the desirableness of more frequently resorting to puncture when the quantity of effused blood is more or less considerable. He supports his advocacy by an appeal to the statistics of M. Bernutz, although that author himself is strongly opposed to the practice in question. Abstracting from M. Bernutz's cases such instances as he thinks may fairly be taken as illustrating the advantages and disadvantages of evacuation, he points out that of 19 cases in which evacuation took place either by spontaneous rupture or by tapping, 16 recovered and only 3 died; while of 11 cases in which no evacuation occurred, 2 only recovered and 9 died. Statistics concerning the value of methods of treatment are avowedly untrustworthy, because it is difficult to eliminate sources of fallacy. Notwithstanding, therefore, the figures quoted above, it may be broadly stated that the weight of opinion is decidedly adverse to artificial evacuation of the contents of hæmatocele as a general method of treatment, and that only in exceptional cases when the symptoms are urgent is an operation desirable. The sources of danger attending artificial evacuation are, purulent infection, provoked in some degree probably by the admission of air into the

sac, and the putrefaction thus set up; the recurrence of secondary peritoneal inflammation, and the renewal of the hemorrhage from its original sources when the pressure of distension is removed. A patient under the conjoint care of MM. Malgaigne and Nélaton died from hemorrhage of a posterior uterine artery which was wounded by the puncture: and a patient operated upon by M. Huguier died of peritonitis provoked by injecting warm water to wash out the contents of the cyst.

The results of some recent experiences, nevertheless, testify that puncture of hæmatocele carefully conducted is somewhat less perilous than was at one time supposed, and hence the operation may be the more readily undertaken in appropriate cases. Thus Dr. Matthews Duncan, a very careful observer, has less fear of untoward results following than formerly prevailed, and he believes that he has repeatedly shortened the duration of the malady by artificial opening. Professor Braun also has observed the rapid cure following the emptying of hæmatocele by puncture.

After a careful examination of all the circumstances, it may be stated in summary that as a general plan of treatment it is most prudent to adopt a palliative method, relieving the symptoms by appropriate remedies as they present themselves, and taking such precautions as are likely to ward off fresh complications. This palliative method should be pursued irrespective both of the size and position of the hæmatocele, and in a large proportion of cases, if perfect quiescence can be enforced, the tumor, even if of considerable dimensions, will gradually and slowly disappear. If, however, all precautions prove fruitless, and the tumor, instead of subsiding, remains long of the same size, or rather shows a tendency to increase, and if, besides, there are constant and severe pains, the recurrence of rigors and marked increase of temperature at nights, with other hectic symptoms, which indicate that suppuration has taken place, then artificial evacuation becomes justifiable and necessary. In some cases, where no distinct signs of suppuration have taken place, the urgency of the symptoms may yet call for operative interference. Thus the persistence of severe and exhausting chronic vomiting, which has been observed in one or two cases associated with large hæmatoceles, and continued and alarming obstruction of the bowels notwithstanding the use of appropriate remedies for its relief—as in a case described by Dr. Meadows—may urgently call for some diminution in the amount of physical pressure only to be obtained by puncture. In undertaking the evacuation of the cyst, great care must be taken not to operate so long as there is any reason to suppose that hemorrhage is still going on within; and further, a sufficiently long time should be allowed to elapse after the formation of the tumor and after the latest increase to its bulk, to permit its boundaries to become consolidated. A too early opening in the intraperitoneal form would most probably lead to the breaking down of the recently formed adhesions constituting the cyst-wall, and the lighting up of fresh and perhaps fatal peritonitis.

In selecting the locality for puncture, the vagina should always be preferred if evacuation there be possible, as the cyst-contents thus gravitate readily from the opening, and less irritation is provoked than when evacuation takes place through the bowel. The irritating and exhausting diarrhœa produced either by spontaneous or artificial evacuation into the rectum frequently adds a new source of danger to a patient already much enfeebled by the previous progress of the affection, and it is well to avoid this if a choice is permitted. In a case of Dr. West's, puncture by the vagina did not prevent a spontaneous opening through the bowel, and hence, if spontaneous evacuation by the rectum seems inevitable from the pointing in that direction, it may be best, notwithstanding the disadvantages named, to expedite escape in that direction, rather than run the risk of a double opening. When the swelling is not readily accessible by the vagina, but reaches high up into the abdomen, it may be possible to puncture it through the abdominal walls; and if there be any obvious pointing externally, it is safer to open it there than by the rectum. The instrument commonly employed is the trocar, and in using it care must be taken in the selection of the site for puncture, lest some of the adjacent viscera be injured. This care is the more necessary, inasmuch as the trocar must be pushed deeply into the sac, so as to penetrate the laminated coagula forming the outer boundaries, which are often of considerable thickness; all possible care also must be taken not to wound any large vessel and to prevent the access of air into the cavity, as this has proved to be one of the dangers besetting the operation, and in no case must the risks be increased by injections to wash out the cavity. Sir James Simpson recommended that the opening should be made with a tenotomy knife and gradually enlarged with the fingers, so that the masses of clot might be discharged by the larger opening. When the opening is made cautiously in this way, there is probably little risk of serious hemorrharge from the edges of the wound; but the objections are, that there must be a large access of air into the cyst cavity,

and it is doubtful whether artificial opening is called for unless the contents have become so liquid that they will run through a trocar. In some cases no doubt the aspirator would prove a very useful instrument. In any special instance where it seems desirable to enlarge the opening, this can always be done after the use of the trocar or aspirator.

The management of patients suffering from hæmatocele in its chronic stages, when no surgical treatment is adopted, equally deserves the careful attention of the medical practitioner. The therapeutic indications are to prevent as far as possible the recurrence of active symptoms, and to promote the absorption of the extravasated blood, with the adventitious products which have followed in its train. For some months, therefore, after the acute symptoms have passed, the patient should have absolute rest at the catamenial periods, and in the inter-menstrual intervals the amount of exertion should be carefully regulated: no great efforts or straining should be permitted, and all excitement of the sexual organs should be avoided. It is necessary to see that the bowels act easily and regularly, and the diet should be nutritious, but not over-stimulating. If there is anæmia, and this associated with continued dribbling discharge of blood from the uterus, acid chalybeates and other tonics may be administered. To aid in dissipating tumor or thickening, the syrups of iodide and bromide of iron may be given; and locally, the application of blisters, of tincture of iodine, mercurial and belladonna ointments may prove serviceable.

The same precautions should be observed when artificial evacuation has been practised or spontaneous discharge has taken place. In these cases besides, great care must be taken to ward off the threatenings of fresh peritonitis, and to support the patient's strength if there is evidence of failing power from profuse discharge, or of grave depression from septicæmia. If there be signs of fresh suppuration after the use of the trocar, with renewed distension of the cyst, the laying open by larger incision will be almost inevitable, and this will then give most relief to the patient.

In all cases continued care and watching will be required long after the necessity for all active treatment has ceased, and the avoidance of all great exertion should be recommended, while change of air and proper hygiene should be prescribed by way of perfecting the recovery of the patient.

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PELVIC CELLULITIS—PELVIC PERITONITIS.[1]

By William Overend Priestley, M.D., F.R.C.P.

Definition. — Inflammation of the cellular or connective tissue, and of the peritoneum subtending the uterus and its appendages in the female pelvis.

Nomenclature and History. — Much confusion exists concerning the nomenclature of these affections, and a diversity of appellations has been employed by authors to designate them, in accordance with the views entertained of their pathological nature. Thus the terms "peri-uterine cellulitis" (Thomas), "parametritis" (Virchow), "peri-uterine phlegmon" (Nonat), have been applied to designate inflammation of the connective tissue in the pelvis: "pelvic peritonitis" (Bernutz), "peri-uterine inflammation" (Courty), "peri-metritis" (Virchow), to indicate inflammation of the peritoneum covering the organs in the pelvis. It is only lately that inflammations occurring in the pelvis outside the uterus and its appendages have been recognized as distinct affections; and still more recently that differences have been pointed out between inflammations in the connective tissue and inflammations of the peritoneal coverings.

The formation and bursting of abscess in the pelvis seems to have attracted the attention of the oldest authors—among others of Hippocrates, Galen, Oribasius, and Paulus Ægineta. These authorities however did not distinguish between abscess of the uterus and surrounding structures. During the last century "pelvic abscess" attracted the attention of several surgeons and obstetricians, and it was by them distinguished from abscess occurring in the parietes of the viscera contained in the pelvic cavity. Delamotte, Ledrun, Bourienne, &c., wrote on this subject as a surgical affection; and Levret, Puzos, and Deleurye directed attention to abscess forming in the female pelvis subsequent to delivery, under the title of "Depôts laiteux;" these authors being impressed with the notion that the formation of pus in this region was the result of a metastasis of milk, the breasts of those women who were the subjects of this complaint being observed either to secrete no milk at all, or to become flaccid previous to the appearance of suppuration. La Motte again considered puerperal pelvic abscess as produced by suppression of the lochia, and relates some interesting examples to illustrate his view.

Cases of abscess in connection with the puerperal state which evidently belong to this category may be found scattered through the medical literature of our own country, corresponding to about the same period. Thus Smellie, William Hunter, and Dr. Denman have severally recorded cases of abscess following delivery, but these authors believe them of rare occurrence.

In the early part of the present century somewhat frequent contributions were made to the pathology and treatment of pelvic inflammations in women, but the writings on this subject were chiefly confined to the one phase — that in which abscess was already formed — and other pathological results escaped notice. In 1827 Dance and Husson published *Memoires sur quelques Engorgements Inflammatoires qui se developpent dans la Fossa Iliaque.* Melier, Téallier, Libeitard, Piotay, Fichot, Grisolle, Bourdon, severally followed in the wake of these. About the same time Dupuytren and Velpeau noticed this affection in lectures, and Martin of Montpellier, and Marchal de Calvi, wrote elaborate and valuable memoirs on the subject.

In Great Britain, a series of cases of pelvic abscess was published by Mr. Wainwright in 1841, and in 1844 a second series by Dr. Lever of Guy's Hospital. Besides these, detached instances were put on record by Dr. Collins, Charlton, and others. The first comprehensive attempt in this country to elucidate the pathology of pelvic inflammation and to point out its comparative frequency, not only after delivery, but in non-puerperal patients, was by Dr. Doherty in a paper on "Chronic Inflammation of the Appendages of the Uterus;" and this was immediately succeeded by an excellent essay "On Abscess of the Uterine Appendages," by Dr. Churchill.

About the same time Sir J. Y. Simpson made "pelvic cellulitis" the subject of lectures in the University of Edinburgh, and seems to have originated the appellation. Soon after this, chapters on

[1] This article was written in 1872.

pelvic inflammation, under the titles of "Cellulitis," and of "Inflammation of the Uterine Appendages," found their way into the systematic works of Henry Bennet, Churchill, and West, in this country, and of Gaillard Thomas in America.

The most recent contributions on the subject are by Drs. Charles Bell and McClintock; MM. Gaillard, Nonat, Bernutz, Aran, and Courty; Virchow, Buhl, and Klob. Dr. Matthews Duncan has lately published an excellent and exhaustive monograph, which discusses all the latest pathological views. He proposes that we should discard former synonyms as imperfectly defining the nature of the two varieties of inflammation in the vicinity of the internal generative organs in women, and employ only the terms suggested by Virchow "peri-metritis" and "para-metritis," the former to indicate inflammation of the peritoneum covering the uterus and its appendages, and the latter the inflammation of the cellular tissue. These appellations are however not free from all objection, and it has been thought best in this essay to adhere to the terms "pelvic cellulitis" and "pelvic peritonitis." These have taken root and are understood by the profession, while confusion is likely to increase from a multiplicity of names, and it is futile to expect to find terms which without change will express the varying views taken of the pathology of these affections. An additional reason exists for abiding by the terms "pelvic cellulitis" and "pelvic peritonitis"— in the fact, that these are adopted in the new "Nomenclature of Diseases" drawn up by the Royal College of Physicians of England, and approved by the Registrar-General.

It is convenient to study both affections together, as they have in a great measure the same causes, approximatively the same symptoms, and require to some extent the same treatment, while they are often associated together; one by contiguity lights up the other, and they may pursue their respective course at the same time and in the same patient.

It is not proposed in this essay to include the forms of pelvic inflammation or abscess, other than those occurring in relation to the female generative organs.

Pathology and Morbid Anatomy.

I. Pelvic Cellulitis.

When inflammation attacks the cellular tissue in the neighborhood of the uterus, it is generally by extension from some portion of the generative apparatus. The cellular tissue in parts of the pelvis surrounding the uterus and its appendages, is very considerable in quantity, and when inflammatory products are formed, exudation takes place into its meshes, in proportion to the intensity and extent of the inflammatory action, and the laxity of the structures involved. The connective tissue is found uniting the several pelvic organs beneath the peritoneum, and exists in abundance between the vagina and rectum, between the uterus and the bladder, and between the folds of the peritoneum which constitute the broad ligaments of the uterus. From these localities it passes by continuity between the rectum and sacrum behind, and upwards it passes into the iliac fossa and along the surface of the psoas muscles posteriorly, and between the peritoneum and transversalis fascia in the anterior part of the abdomen. The peritoneum is so closely adherent to the anterior and posterior aspects of the uterus, that the cellular tissue there is sparing in quantity. The rectum, vagina, and urethra are each inclosed in a tube of pelvic fascia, and in normal conditions are enabled to glide about in their respective sheaths in the performance of their functions, through the loose attachment of the connective tissue about them.

Some French authorities have endeavored to draw a distinction between inflammation of the cellular tissue immediately surrounding the cervix uteri, and that inclosed in the folds of the broad ligaments which stretch out laterally to the walls of the pelvis, and have described them as separate pathological affections. This separation, scarcely called for by the circumstances, is more likely to lead to confusion than clearer definition of the subject, and practically is of no great value.

It is obvious that the system of connective tissue may become inflamed by extension of mischief from the intestine, pelvic or vertebral bones, or other structures apart from the generative organs. These varieties of cellulitis however are not gynæcological affections and are not included in this article.

It is important to remark that pelvic cellulitis occurs both in puerperal and non-puerperal women, and is not necessarily synonymous with pelvic abscess. Suppuration is only *one* of the results of cellulitis, and it has been pertinently remarked that it would be as incorrect to apply the term empyema to all cases of pleurisy as to give the appellation of "pelvic abscess" to all cases of "pelvic cellulitis" because suppuration is one of the occasional terminations.

The pathological results are—1. Congestion and the effusion of serum; 2. The exudation of coagulable lymph; 3. The formation of pus.

1. The effusion of serum is the first and

earliest product of the inflammatory action after it passes beyond the stage of mere hyperæmia. The infiltration of fluid exudation through the meshes of the connective tissue gives rise to swelling of a more or less elastic character in some portion of the pelvic cavity, which may be detected if examination is made sufficiently early. Even at a more advanced period, when the centre of the swelling is hard and firm from denser exudation, an outer and somewhat softer circle may be felt of serous effusion. Examples of this kind of effusion also sometimes present themselves in the œdematous swelling of the recto-vaginal septum when the circulation above is obstructed by the presence of either hæmatocele or inflammatory phlegmon. In some patients of feeble power and impoverished blood, the inflammatory action has no tendency to go beyond the stage of serous effusion, which may nevertheless be of considerable quantity and form a bulky tumor in the pelvis. Sir James Y. Simpson relates an instance in which a considerable quantity of serous fluid was drawn off with an exploring needle, which coagulated as it grew cold. Unfortunately there is no sufficient proof from the history of this case that the fluid was not an encysted serous collection of fluid in the peritoneum, and, as we shall see presently, the more recent investigations of M. Bernutz and Dr. Matthews Duncan throw doubt on this point. There is abundant proof nevertheless that serous effusion does take place in the connective tissue about the uterus and its appendages. The semi-elastic swelling thus produced may be observed in some instances gradually extending from an irritable ovary or from the uterus in a state of chronic inflammation, whenever hyperæmia exceeds certain limits and affects the surrounding parts, and it creeps along, sometimes rapidly, sometimes more slowly, distending the meshes of the cellular tissue until possibly it invades a large space in the posterior and lateral parts of the pelvis, and even runs up above the pelvic brim into the iliac fossa. When the loculi of cellular tissue, bounded by firm and unyielding layers of fascia, and denser subperitoneal connective tissue, become tense from effusion, the swelling acquires a sense of firmness so great that it may readily be taken for lymph deposit or for solid growth. The rapidity however of its subsidence when action abates, and the entire disappearance of thickening within a comparatively short space of time, as recovery progresses, forbid the inference that the tumefaction was due to exuded lymph, either in the connective tissue or on the surface of the peritoneum. The alternate development and recession of this kind of intumescence is very remarkable in some cases, and instances have been observed where the ovaries were so irritable that the approach of each catamenial period was attended by this kind of serous infiltration into the surrounding parts, and where it was absorbed habitually after the termination of the period.

Dr. West compares some of these forms of pelvic effusion to those inflammations of the cellular tissue which succeed to operations, and which have been named, by the distinguished Russian surgeon Pirogoff, "acute purulent œdema." He describes the fluid as a thin sero-purulent matter, which often retains its character long after it has formed in quantity sufficient to impart to the fingers a most marked sense of fluctuation. This analogy may hold good in a certain proportion of cases, but there are doubtless besides forms of œdema which are not purulent, as may be inferred by the rapid absorption and disappearance of the tumor.

2. The exudation of the coagulable lymph takes place whenever inflammation reaches the second stage, and this occurs in the majority of cases of cellulitis.

The amount of deposit so thrown out varies much in accordance with the acuteness of the inflammatory action and also with its duration. It may be so inconsiderable as to produce only some thickening in the pelvis, and render it difficult to determine whether the exudation is in the cellular tissue or on the free surface of the peritoneum, or it may be to such an amount that it completely surrounds all the pelvic organs, fills the pelvis, and mounts up as before stated by the continuity of the connective tissue into the abdomen or iliac fossa. When the tumor is very large and projects above the pelvic brim, it will in most cases be found that the uterus itself is much increased in size and forms part of the mass, and also, as pointed out by MM. Bernutz and Goupil, and by M. Aran, that peritoneal adhesions are formed which unite folds and coils of intestines together and thus add to the bulk.

The most notable characters of the tumor thus formed are its hardness, irregularity, and immobility. The exudation, being thrown out between the laminæ of fascia which traverse the pelvis in different directions, and extending commonly from the lateral margins of the uterus to the bony wall of the pelvis, completely fixes the womb, and the swelling feels as though plastic plaster of Paris had been poured in and hardened there. So firm is the lymphy deposit in some cases, that if at all rounded in form it may be taken for an exostosis in the pelvis. Dr. Doherty compared the thickness and density to that of a "deal board." The immobility and irregular form serve to distinguish it from fibroid and ovarian tumors. At first the swell-

ing may seem to be rounded in form, but as it extends it becomes more irregular in outline, and if its progress be watched from day to day, it may be noticed passing from the centre to the circumference of the pelvis, and, extending it may be in front or behind the uterus, it reaches over to the other side of the pelvis. The position of the swelling varies, and its shape and progress are modified by the arrangements of the fascia in the pelvis, and by the firm attachments of the peritoneum to certain portions of the pelvic viscera. The anatomical arrangements of the female pelvic fascia, and the way in which they influence the course of cellular inflammation here—more particularly the direction taken by pus when formed—have been carefully studied by M. Jarjavy in France, and by Drs. Priestley and Savage in this country. König has published a still later contribution on this subject, and he details experiments made by injecting air and water into the cellular tissue under the broad ligaments. He infers that inflammatory effusion must necessarily extend itself in definite directions pointed out. Interesting as these investigations are, it must be observed that practically they do not afford a very accurate guide as to the direction in which exudation may extend. In the travelling of fluids, such as serous effusion and purulent matter, the planes of fascia and close attachments of the peritoneum exert a most important influence, and direct pointing to the least resisting part; but when inflammatory exudation is in active progress, it readily passes by contiguity from one loculament of cellular tissue to another, until all is one fused mass, the layers of fascia opposing no efficient barrier. When a pelvic phlegmon localizes itself within moderate limits, so that it forms a definite tumor, its most frequent sites are between the cervix uteri and rectum, and in the direction of one or other broad ligament on the lateral aspects of the uterus. From these localities it may mount up and invade the loose cellular tissue in the iliac fossa, a continuous tumor extending thus from the true pelvis into the false. Occasionally the swelling is found bewteen the uterus and the bladder; and in rarer instances it lies in front of the bladder altogether. When situated so far forward as this, it has generally extended from the centre of the pelvis, and having reached this locality may run upward along the cellular tissue, which exists abundantly between the transversalis fascia and peritoneum, until it reaches the umbilicus and forms a tumor in the anterior part of the abdomen.

3. *Formation of Pus.*—Suppuration does not commonly take place until ten or fourteen days after the onset of the attack, even in acute cases, and in the chronic forms the indications of its having occurred are often much later than this. The large amount of surrounding exudation often so entirely masks the evidence which fluctuation commonly affords of the presence of pus, that it may not be detected until long after it is formed. Frequently indeed it escapes by the rectum mixed with the stools before fluctuation has been discovered, partly probably because the pointing has been beyond the reach of the practitioner, and partly from the presence of surrounding lymph exudation. When suppuration occurs it does not necessarily take a diffuse form, but it begins, it may be, in a loculament formed by layers of pelvic fascia, which, if of sufficient density, may circumscribe the pus, and direct it towards the surface or canal by which it can be discharged. Occasionally suppuration is more general and a large pelvic abscess is formed, the dissepiments being broken down, and the loculi communicating one with another. Cases have been observed where suppuration, beginning in the true pelvis, has mounted up into the iliac fossa; or where it has begun in the iliac fossa, and passed down by the cellular tissue of the mesorectum into the pelvic cavity. Suppuration has been seen to extend from the pelvis so as to occupy the whole iliac fossa on one side and reach upwards as high as the kidney. Many examples have been recorded, where suppuration has extended from the front of the pelvis upwards behind the abdominal walls—evacuation taking place near the umbilicus. Again, two or three centres of suppuration may be formed, each bound by its respective laminæ of fascia or dense peritoneum, and these may point in different localities, each abscess having a separate opening and bursting at different times.

Mr. Spencer Wells saw a lady in whom a pelvic abscess discharged not only through the rectum, the bladder, the vagina, and the loin, but gravitated down the leg, to open in the calf.

In some rare cases suppuration has been so extensive and destructive as to lead to sloughing of large portions of the pelvic areolar tissue, and Dr. M. Duncan, in the work previously alluded to, devotes a chapter to this subject.

Pointing and evacuation of pus may take place by the external surface of the body, by the bowel, by the vagina, by the bladder, or urethra, and in rare cases by the uterus and Fallopian tubes. In still rarer instances, the outlet has been through the floor of the pelvis near the anus, or through the obturator or sacro-ischiatic foramina.

In abscess following delivery evacuation probably takes place most frequently through the abdominal walls. In thirty-seven puerperal cases observed by Dr.

McClintock, twenty abscesses discharged through the skin in the iliac regions; two above the pubes; one in the inguinal region; and one beside the anus; of the remaining thirteen, six were discharged per vaginam, five per anum, and two burst by the bladder. In the non-puerperal variety Dr. McClintock believes it is extremely rare for an abscess to discharge internally. In the non-puerperal variety evacuation most frequently takes place by some portion of the intestinal canal. The position of the tumor is more frequently observed in the posterior half of the pelvis than in any other locality, and if suppuration takes place the whole outer surface of the rectum can be surrounded by the pus, on account of the loose character of the cellular tissue about it, and as the bowel presents only a thin wall between the abscess and mucous tract, it is readily perforated. Occasionally the perforation is higher up, in the sigmoid flexure of the colon. The next most frequent channel for evacuation internally is by the vagina, and after this, by the bladder. Instances are rare where an opening has been effected through the walls of the uterus or Fallopian tubes. The thickness of the uterine walls, their resisting character, and the way they are still further enforced everywhere by the close adhesion of the dense peritoneum on the outer surface, except on the lateral margins, accounts for this rarity; but examples have been recorded by Lisfranc, Hawkins, Battersby, Marchal de Calvi, and others. Bursting into the peritoneal cavity is also fortunately as rare as it is most disastrous. The peritoneum lining the pelvic cavity is much thicker than that covering the intestines or other abdominal viscera. It is also so enforced by strong fibrous tissue in this region, that it may well act the part of a fascia, in offering resistance to, and directing the contents of an abscess beneath. In most cases of inflammation too it is still further enforced by plastic exudation on its free surface, and thus its integrity is preserved.[1]

The following notes and results of the autopsy in the case of a young woman who died from the effects of a pelvic abscess following abortion, illustrate the pathology of the subject. The immediate cause of death was the exhaustive diarrhœa produced by the constant discharge of purulent matter into the intestine.

Before death an indistinct swelling, about the size of an orange, could be felt through the abdominal walls at the back of the pelvis. On examination, per vaginam, a tumor of irregular form was found behind the uterus. It extended from side to side in the upper part of the concavity of the sacrum, and was most prominent in the median line, where it bulged forward the cervix uteri and upper part of the vagina. The uterus was pushed altogether somewhat towards the symphysis pubis, and the rectum was compressed into a flattened form behind, being everywhere surrounded by hardened deposit. No fistulous opening could be reached by the examination per anum. The whole structures at the back of the pelvis were fixed and immobile, and the uterus was as fixed behind as if encircled by malignant infiltration. The ease with which the finger could be passed through the rectum excited attention. Its calibre was curiously preserved, considering the denseness of deposit around it. The body was much emaciated and very anæmic. On laying open the abdominal walls, there was no sign of inflammation until the intestines were removed from the pelvis. Then the coils lying lowest and posteriorly were found to be injected and slightly adherent to each other, and to the peritoneum beneath. A small quantity of serum containing flakes of lymph was also observed in this locality. The plastic exudation covering the intestines had all the indications of being recent, and its adhesive power was so low that the adhesions readily broke down. The entire uterus was pushed forward by a swelling on its posterior aspect, the bulk of which was about that of a medium sized orange. This was distinctly beneath and outside the peritoneum, and there was no difficulty in tracing the continuity of that membrane over the surface of the tumor, although it was covered with flakes and patches of lymph, and here and there crossbands of soft adhesion passed from it to the intestines and sacral peritoneum. On cutting into the tumor it was found to be partially but not entirely filled with offensive pus, intermingled with fecal matter. An aperture, large enough to admit a crow's quill, communicated high up with the middle third of the rectum, and was at the upper part of the abscess, so that no proper drain of its contents could take place, but some of the contents of the bowel had passed into it. The cavity was regular in form, large enough to hold from one to two ounces of pus, and was lined with an ashy-looking pyogenic membrane. The uterus was enlarged and indurated, and its posterior wall almost as high as the fundus formed the anterior boundary of the abscess. The rectum and concavity of the sacrum formed the posterior boundary. Below, the mass was wedge-shaped, and almost reached the true pelvic fascia, a little below the level of the os uteri. Above, the peritoneum—its sub-cellular tissue much thickened by deposit—formed the

[1] For illustrations of other rarer forms of opening and discharge of pus, see Edinburgh Medical Journal, 1854.

roof. Everywhere around, but especially on the lateral margins, there was abundant hard plastic deposit, which fixed firmly the surrounding parts, and which creaked under the knife. The section looked like bands of dense fibrous structure with intervening pellets of fat. The ovaries and Fallopian tubes were slightly adherent to surrounding parts, but were otherwise healthy.

II. Pelvic Peritonitis.

1. Plastic Exudation. — Some of the minor pathological results of pelvic peritonitis are sometimes remarked in association with the progress of certain diseases of the pelvic organs, as, for example, the dryness and sense of friction which may be detected with the hand and stethoscope over the surface of fibroid and ovarian tumors, when the earlier stages of inflammation are in progress or have passed. Thickening and roughness on the peritoneal surface of pelvic tumors and over the surface of the pelvic organs generally, is not unfrequently observed in post-mortem examinations. The commonest effect of inflammation of the pelvic peritoneum is to throw out lymph exudation, which glues the organs together, and fixes them by adhesion. In this way the uterus becomes fixed to surrounding parts—most commonly by its posterior surface, where its peritoneal covering is most extensive, and then it is found to have lost its mobility in that direction, and to be inseparable from the rectum and sacrum. The tying down of the retroflexed uterus by peritoneal adhesions with such security that it is impossible to rectify the position either by finger or sound is familiar to most practitioners; and equally common is the fixing of the ovary from the occurrence of ovaritis, either to the structures near its natural position, or down in the recto-uterine cul-de-sac, into which it has previously sunk from its increased volume. The adhesions thus formed may so entangle and maim the various portions of the generative apparatus, as seriously to impede the performance of function. The ovaries and Fallopian tubes may be so surrounded by inflammatory deposit, that the elimination of ovules is obstructed, and menstruation is either suppressed, or is rendered painful and difficult. In like manner the fixing of the uterus may be a bar to impregnation, or, if conception occurs, the expansion and ascent of the womb is prevented, and abortion takes place.

The plastic exudation of pelvic peritonitis sometimes glues together the pelvic organs and coils of intestine, so as to form a considerable tumor, which may, according to Bernutz, be mistaken for cellular phlegmon or some other pathological condition.

It may be remarked concerning the presence of these adhesions, that they may arise by extension of inflammation to the peritoneum from the cellular tissue beneath, and from the organs situated in the pelvis. They are produced also in the progress of cancer, and fatal terminations are thus in a measure averted. Further, in strumous patients there is a marked tendency to the association of tubercle with the inflammatory exudation, and thus pelvic peritonitis may become really a form of tubercular peritonitis.

2. Encysted collections of serous fluid in the peritoneal cavity have been described by various authors as pathological results of pelvic peritonitis. M. Huguier, in his paper "On Cysts of the Uterus, &c." mentions two cases where "serous cysts of the uterus" were produced by metro-peritonitis, and these were recognized during life. The case recorded by Sir J. Y. Simpson, previously alluded to, in which a considerable quantity of transparent and coagulable fluid was drawn from a pelvic inflammatory tumor by an exploring needle, was probably of this nature—although Sir James believed the collection to be in the cellular tissue. Under the appellation of "encysted serous perimetritis" Dr. Matthews Duncan has described two instances occurring in his own experience in which he believes peritonitis led to the formation of local collections of serous fluid, having all the characters of cysts, but the cyst-wall being formed "by the parietal peritoneum on the one side, and various parts of the bowels and uterus on the other side; these various parts being united by adhesions, as is frequently observed in cases of perimetric abscess and hæmatocele." The fluctuating tumors were at first supposed to be abscesses, but, when punctured, proved to have serous contents. As Dr. Duncan's patients recovered, no opportunity was afforded of verifying the diagnosis, and determining the actual position of the fluid, but the reasons advanced in favor of his view of the nature of the cysts are sound and precise, and leave little doubt concerning the accuracy of his inferences. Dr. Thomas, of New York, also describes a case in which he drew off one or two ounces of serum produced by pelvic peritonitis. Limited collections of serous fluid in the peritoneal sac have been observed in connection with the low form of peritonitis associated with malignant disease of the uterus and adjacent parts. An excellent example of this kind is recorded by Dr. Fiorget of Strasbourg, and quoted by Dr. Duncan. The author has seen on more than one occasion, limited collections of fluid formed

in the lower part of the abdomen as the result of tubercular peritonitis, which have a pathological relation to those under discussion. The patients were young emaciated girls, and the tumors so formed bore a close resemblance to cystic ovarian disease.

3. When suppuration takes place in the course of pelvic peritonitis, it may be at any part of the peritoneal surface where antecedent inflammatory products have been formed. Commonly the formation of pus is localized so as to form a limited abscess. If more extensive, the pus is contained in loculaments or cells which may communicate, or be separate, forming a series of distinct abscesses.

In position, the tumor so formed may be either between the uterus and rectum in the space of Douglas, or in some other part of the pelvic cavity. Baudeloeque in his Traité de la Peritonite (1830), and Andral in his Clinique Médicale (T. ii., p. 722), have recorded cases of peritoneal abscess circumscribed to the recto-uterine cul-de-sac, and Bernutz and others have published similar cases. If above the true pelvis, it forms a tumor either in the hypogastrium or iliac fossa. Then adhesions and thickening from lymph exudation can commonly be traced down to the uterus and its appendages, indicating that the origin of the inflammation has been in the genital organs. Occasionally intra-peritoneal abscesses are formed at a considerable distance from the uterus, although the inflammation has originated there, and the track of the inflammatory progress is marked by lymphy exudation. Dr. Duncan watched a case where, during the progress of post-partum local peritonitis, a lump the size of an orange appeared between the navel and pubes, and which he believed to contain pus. The tumor was attached to the abdominal wall and moved with it, and between it and the pubes there was hardness, but not absolute dulness. The swelling soon disappeared, but no pus was ever observed in the stools, the inference being that the abscess burst into the upper portion of the alimentary canal. The doubt suggests itself, whether in this single case, the tumor, so quickly disappearing, was not a *serous* collection of fluid, speedily absorbed on bursting. Be this as it may, the occurrence of successive abscesses in different portions of a mass of lymphy deposit within the peritoneal cavity situated in the pelvis has been established, and each new centre of suppuration may give rise to a renewal of active symptoms. If the abscesses converge, they may unite and communicate freely with each other, the interior of the general abscess then representing a series of amygdaloid cavities,—not unlike the burrowings of a mammary abscess.

In the more extensive forms of suppuration connected with pelvic peritonitis, it is not uncommon to find one or both Fallopian tubes also distended with pus, and perhaps a separate purulent collection in the ovary, as well as in the cellular tissue of the broad ligament (Scanzoni).

The post-mortem appearances in pelvic peritonitis ending fatally, are well illustrated in the following typical case published by M. Bernutz, and in the subsequent description of parts on dissection by M. Aran:—

"On opening the abdomen, the bladder, uterus, broad ligaments, and sigmoid flexure were all bound together by old firm adhesions. The posterior surface of the bladder was united to the uterus by two bands of adhesions—one of which passed on to the sigmoid flexure, the other united also the Fallopian tube to the sigmoid flexure. Between these two vesical bands, the vesico-uterine peritoneal cul-de-sac was healthy. The right broad ligament covered by the membrane from the bladder formed, as it passed behind the border and right angle of the uterus, a *demi-involucre*, which constituted the upper and internal wall of the pelvic cavity of that side. All this peritoneum was covered with false membrane. On the left there was no pelvic cavity, the broad ligament was united to both bladder and rectum; on quietly separating these adhesions, an intra-peritoneal abscess full of pus was opened; it was situated in front of, and below the ovary, being in direct contact with peritoneum covering that viscus. The uterus itself was bound posteriorly to the rectum, but was also acutely ante-flexed. The Fallopian tubes were highly congested. The right contained two small purulent collections, one at the fimbriated extremity, which was dilated and firmly adherent to the ovary. The left tube was impermeable, but contained no pus. The ovaries were both healthy. The cellular tissue of the broad ligaments and uterus was perfectly healthy. If we set about," says M. Aran, "with care the dissection of the tumor, we find that it is constituted, proceeding from without inwards, by false membrane, still soft and pretty easily torn, forming a layer more or less thick, sometimes quite continuous, at other times hollowed out here and there by a certain number of locules full of a liquid, sometimes yellow and transparent, sometimes sero-purulent, or perhaps true pus, somewhat liquid and very serous. I have seen some of these cavities hollowed out in the false membranes, which contained a teaspoonful, sometimes even a tablespoonful, of purulent serosity or of pus. Underneath the false membrane we observe, in the peritoneum of the subjacent parts, the evident marks of a recent in-

flammation, very fine and very close injection, thickening, and a serous infiltration of the subperitoneal cellular tissue, which allows the membrane to be easily peeled off. In the centre of the tumor we find perhaps one of the appendages of the uterus, perhaps the two appendages of one side,—ovary and tube—exhibiting some of the alterations which we have described *à propos* of acute inflammation of the ovary or of the tube, and the inflammation may extend as far as the broad ligament, the peritoneum of which may be very brightly injected, and the cellular tissue infiltrated with serosity, sometimes sanguinolent, more rarely purulent."

M. Bernutz, an author whose opinion deserves all consideration and respect, has labored to prove, that the supposed inflammatory tumors of the cellular tissue in the pelvis, which have been described by various writers, are in reality misinterpreted cases of pelvic peritonitis, the swelling being produced by cohesion of convolutions of intestine to each other, to the uterus, and to the surrounding parts, and that when collections of matter are formed it is commonly inside the peritoneal cavity. He places himself in especial antagonism to M. Nonat, who has described inflammation of the pelvic cellular tissue under the appellation of "peri-uterine phlegmon," as of frequent occurrence, and expresses his belief, that while cellulitis is rare and never forms a bulky tumor, pelvic peritonitis is common, and has hitherto been mistaken for inflammation of the connective tissue. As in the case of peri-uterine hæmatocele, he compares the pelvic peritoneum in the female to the tunica vaginalis subtending the testicle in the male, and draws a parallel between the pathological results observed in the two serous membranes,—claiming an almost exclusively intra-peritoneal seat for the inflammation in both localities.

M. Aran, M. Courty, and Dr. Matthews Duncan so far agree with M. Bernutz, that they believe a *large* pelvic inflammatory tumor cannot be formed solely at the expense of the peri-uterine cellular tissue, and that when of any considerable size it is formed in the course of pelvic peritonitis by the adhesions of the various pelvic organs to each other. Both M. Aran and Dr. Duncan nevertheless attest the frequency of inflammation of the connective tissue, and Dr. Duncan seems to admit, that bulky tumors may be formed solely by thickening of the sub-peritoneal cellular tissue above the true pelvis.

To M. Bernutz is undoubtedly due much credit for the elucidation of the pathology of pelvic peritonitis. The subject had before his investigations been almost overlooked, or merged and confused with cellulitis. M. Bernutz has nevertheless pushed his conclusions too far, and in his contention has even misrepresented the opinions of others, notably of M. Nonat. In accepting a part of M. Bernutz's views, therefore, it is not necessary to impugn the accuracy of other observers, who attest the frequency of cellular inflammation and its results. The *relative* frequency of pelvic peritonitis, and of pelvic cellulitis, must be left for further investigation to determine.

CAUSES.—An important point in the etiology of pelvic cellulitis and peritonitis has recently been discussed, viz., whether these affections are idiopathic, or have an independent origin, or whether they are always secondary, and result from extension of inflammation originally set up in some part of the genital apparatus. By Drs. Churchill, Bennet, Nonat, and others, they are described, in many cases at least, as separate or idiopathic affections, which may occur without preceding acute inflammation of the uterus or its appendages. M. Piotay first enunciated the view that inflammation of the uterus always precedes that of its annexes. M. Aran says that "the causes of peri-uterine inflammation are those of inflammation of the tube, and of the ovary, which is almost constantly the starting-point." Dr. West adopts the same view, and Dr. Matthews Duncan especially insists that peri- and para-metritis, as he terms them, are always secondary or the result of injury, and of all the prolific causes, inflammation of the mucous membrane of the womb, or endometritis, is the most common, both in the puerperal and non-puerperal states. The tendency of recent investigations is no doubt to show that the uterus, ovary, or Fallopian tube are the *points de départ* in the majority of cases, even if inflammation of the pelvic connective tissue and peritoneum are not exclusively propagated from these sources.

The causes therefore may be broadly stated to be those of inflammation of the uterus and its appendages: in the puerperal state, injuries produced by instruments during delivery, by turning, and by the pressure of the fœtal head on the maternal soft parts, when labor from any cause has been over-protracted.

Irrespective of physical injuries, the peculiar "constitution of women" in the parturient state, illustrated by Dr. Charles Bell, is a strong predisposing cause to pelvic inflammation. Dr. West thinks that delivery and abortion stand in the etiology in the proportion of 77 to 100; and M. Bernutz states that about 44 per cent. are puerperal—the average between the two being about 60 puerperal cases in 100.

Special circumstances in the puerperal

condition seem also to exercise an influence in the causation. Thus MM. Piotay and Grisolle affirm that primiparous patients are more predisposed than others to pelvic inflammation, probably because of the greater protraction and difficulty of first labors. M. Grisolle states that out of nine cases of pelvic abscess subsequent to delivery seven were primiparæ. The same author declares that women who do not suckle their children are more disposed than others to phlegmon of the pelvic cavity. He writes, that in every case he had observed following accouchement, "not one of the patients had suckled her own child, and the same appeared to be the case with every history transmitted by other authors." Further it has been observed that whenever the uterus contracts imperfectly after delivery, and is left abnormally large and relaxed in tissue, if the patient escapes general blood poisoning, there is a greater proclivity than usual to the development of metritis, and the extension of inflammation to the surrounding parts. Lastly, the getting up of the patient, the resuming of her occupations, or returning to her husband's bed, too soon after delivery or abortion, and before the generative apparatus has fully recovered the effects of the puerperal state, are fertile sources of pelvic inflammation.

Among the causes in the non-puerperal woman may be enumerated—sudden suppression of menstruation from cold or other causes; mechanical injuries, either from accident or surgical interference; divisions of the cervix uteri; amputations; attempts to enucleate fibroid tumors; the use of intra-uterine pessaries; of laminaria and sponge tents; the application of escharotics to the cervix; and injections into the uterine cavity; the injudicious or rough use even of the ordinary instruments for diagnosis in uterine cases, may all be followed by pelvic inflammation. In the typical case of pelvic peritonitis recorded by M. Bernutz, the post-mortem results of which are given in a previous page—the inflammation was provoked by the mere passing of a uterine sound. The employment of strong vaginal injections may also stir up these forms of inflammation, and when the cervical canal is unusually patent, even injections of slight potency may run along the Fallopian tubes and produce serious symptoms. Further it must be added that in sensitive women coitus in early marriage, or its too frequent repetition at any time, may set up inflammatory action; and this is more readily developed when there has been some pre-existing uterine disease.

Authors agree in attributing to gonorrhœa an important share in the production of pelvic inflammation. Of M. Bernutz's 99 non-obstretric cases 28 were blennorrhagic. The study of these forms is interesting, inasmuch as they illustrate the way in which inflammation of the uterine mucous membrane in endometritis may extend itself along the Fallopian tubes, both to the ovaries and pelvic peritoneum. It may be stated that in this class of cases the form of affection assumed is much more frequently that of pelvic peritonitis than cellulitis, and it is one of the most intractable and frequently-recurring forms.[1]

Dr. Duncan dwells on the importance of recognizing the secondary character of pelvic cellulitis and peritonitis, more particularly as the pre-existence of endometritis may be overlooked on account of the more prominent symptoms of the secondary affection, and he moreover believes that swelling and tenderness of the ovary which often precede cellulitis or peritonitis are due primarily to an extension of inflammation from the uterine cavity.

Lastly it may be mentioned that uterine fibroid tumors, uterine displacements, pelvic hæmatocele, malignant disease of the generative organs, and tubercular disease, may in their progress be attended by intercurrent cellulitis and peritonitis, and in cases of cancer, peritonitis is sometimes present, without the malignant disease having distinctly reached the surface of the peritoneum.

Symptoms and Progress.—Cases of pelvic-cellulitis and peritonitis in regard to their symptomatology range themselves in two great classes. In the one class the attack is acute and the symptoms both general and local are well defined. The acute form is commonly ushered in with a rigor, and this is followed by fever, with increased temperature, flushing of the countenance, furred tongue, and an accelerated pulse. The urine is scanty and loaded with urates, and there is often pain and difficulty in micturition. Sharp pain is complained of in one or other iliac region or in the hypogastrium, and firm pressure affords no relief, but aggravates the uneasiness. A sense of dragging is often experienced about the umbilicus, and attempts to walk, or even to sit upright, bring increase of distress. Following delivery or abortion, the first indications not unnaturally raise the suspicion of coming puerperal fever with general peritonitis; and it is only by observing the localization of the inflammatory action as the attack progresses, that its true character is ascertained. As in the more undoubted forms of puerperal fever, the breasts may become suddenly flaccid, or the secretion of milk from the first be ar-

[1] On this subject see a recent contribution by Noeggerath.

rested, and the lochia suppressed. In some of the forms at least, more particularly those which do not result from mechanical injury, there is an alteration in the blood analogous to that existing in puerperal fever and phlegmasia dolens, but the morbific action is less in degree than in the more serious forms of puerperal fever, and the results are more distinctly localized. In an acute attack of pelvic-peritonitis it is nevertheless not uncommon to find the abdomen tympanitic as well as exquisitely tender; the thighs flexed on the belly and the countenance anxious as in cases of general peritonitis. In the graver cases there may be severe headache and other forms of cerebral disturbance amounting even to delirium, and sympathetic vomiting may greatly add to the distress of the patient. Then, as in general peritonitis, the temperature instead of being above may be below the normal standard, indicating a condition, as pointed out by Wunderlich, always suspicious and full of peril.

In the slow or chronic forms, the advent of the disease is accompanied by symptoms much less prominent, and sometimes it may be so insidious as almost to escape observation, or at least to be misinterpreted. As before stated, both adhesions of the pelvic organs, and masses of inflammatory exudation in the cellular tissue, are frequently found on vaginal examination, the exact date of which it is difficult to determine, because their formation has been attended by no sufficiently grave or definite signs. As early as 1843 Dr. Doherty called attention to the slow and insidious progress of chronic inflammation of the appendages of the uterus, which might end in abscess without any very prominent symptoms, and which sometimes occurred after the period when the puerperal woman is usually considered most obnoxious to inflammatory attacks. In the chronic form nevertheless, both in the puerperal and non-puerperal woman, although there may be no distinct rigor or pyrexia, the patient ordinarily complains of deep-seated uneasiness in the pelvis, combined it may be with increasing dysuria and constipation, and there is gradual failure of general health.

Such is the obscurity of the symptoms accompanying chronic pelvic-peritonitis after abortion or delivery that they are apt to be misinterpreted. Often the one prominent feature in these cases is grave and abiding discomfort in the region of the bladder, with frequent and painful micturition, and as the urine frequently contains pus, the symptoms are liable to be attributed to chronic inflammation of the bladder. Nevertheless a more careful investigation will prove that greater constitutional disturbance is present than the mere affection of the bladder will account for. There is anxious countenance, general wasting, inability to take food, and febrile disturbance which is indicated by a rise both in the pulse and temperature. Moreover tenderness on pressure over the hypogastrium extends beyond the limits of the bladder. Vaginal examination further discloses the fact that a partial or complete roof is formed to the pelvis, by exudation and by adhesion of all the structures there, and it is then obvious that the bladder affection is only a secondary complication of a more general pelvic inflammation.

In many cases of pelvic cellulitis and peritonitis the discomforts complained of may not entirely preclude the ordinary occupations of the patient, but these are performed with difficulty and with increase of pain. The pain varies in character from mere uneasiness to acute suffering, especially on exertion. It is often described as shooting and lancinating from the hypogastric or iliac region to the loins and umbilicus, or to the perineum and lower extremities. Sometimes it is pulsating and throbbing in character. There is a sensation of burning and weight in the pelvis, and an indisposition to remain in the erect posture. Not unfrequently pain assumes a periodic character, and returns in distressing paroxysms from time to time, with comparative immunity of suffering between. In cases where inflammatory exudation reaches the walls of the pelvis, there may be a nightly and severe exacerbation, as in inflammation of the long bones, probably because the periosteum is involved in the morbid action.

Pains complained of in the lower extremities are often somewhat anomalous in character. One patient suffering from cellulitis refers her chief pain to the knee-joint, after the manner of those who are the subjects of *morbus coxarius;* another, with a large inflammatory tumor deeply situated on one side of the pelvis, has her attention mainly occupied with severe pain on the dorsum of the foot on the same side. Again, it may be the external cutaneous nerve of the thigh which is the chief seat of pain, the crural nerve in front, or the great sciatic behind, which is complained of. M. Grisolle pointed out that retraction of the thigh on the pelvis is a common and characteristic sign of the presence of an inflammatory tumor in the pelvis, more especially when it extends to the iliac fossa and implicates the muscles and nerves in that locality. *Adduction* of the limb with pain down the inside of the thigh, is occasionally observed when the parts on the inner aspect of the obturator foramen are involved. Œdema of the leg on the side affected occurs whenever the inflammatory action

is extensive enough to involve the trunks of the large bloodvessels, which proceed to the lower extremities. Dr. Doherty conceives this œdema to depend not so much on physical pressure as on disturbances of the absorbent system, and occasionally it runs into phlegmasia dolens. There is no doubt, from time to time, a concurrence of pelvic cellulitis or peritonitis and phlegmasia dolens. M. Grisolle mentions a case where arterial pulsation in the lower limb was less distinct on the side where there was a phlegmon in the pelvis, and the temperature of the leg was lowered. Other symptoms referable to the effects of physical pressure and adhesion in the pelvis are *dysuria* and a constant desire to pass water when the bladder is implicated. Dr. Hicks has described cases in which incontinence of urine was produced by pelvic adhesion in cellulitis. There is bearing-down and pressure on the rectum when the bowel is involved. As in hæmatocele there may be incessant desire to go to stool, and the act of defecation is effected with pain and difficulty. The rectum is so constricted by lymphy exudation in some cases that the feces are flattened into a ribbon form, and the irritated intestinal mucous membrane exudes so much half purulent mucus, occasionally tinged with blood, that it may erroneously be taken for a discharging abscess. Obstinate constipation is so constant an attendant on the early stages of pelvic inflammation that it has been enumerated among the causes of the affection. During the later stages the condition of the alvine functions is more variable, and diarrhœa may alternate with costiveness, while if an abscess discharges into the intestinal track the diarrhœa is likely to be severe and exhausting. In rarer cases the irritation of the bowel assumes a truly dysenteric form. Leucorrhœal discharge and metrorrhagia are among the less constant symptoms. Commonly there is more or less muco-purulent discharge due to congestion of the cervix uteri and vagina. M. Bernutz describes metrorrhagia as among the invariable concomitants of pelvic peritonitis, but assuredly it is less characteristic of this affection than of hæmatocele.

Pains in distant parts of the body, and sympathetic forms of disturbance, pelvic cellulitis and peritonitis have, in common with closely allied uterine and ovarian affections: in the chronic forms, habitual backache, with infra-mammary pain, pains in the mammæ, derangements of digestion, and the several forms of neuralgia, are inconstant and varying signs. The recurrence of vomiting in chronic cases is often very troublesome, and sickness is certainly most frequently present whenever the ovaries or peritoneum are involved. When a patient has to a great extent recovered, repeated attacks of nausea and sickness may occur if one or other ovary is yet bound down by adhesions, and impeded in the periodic performance of its functions.

In the chronic cases, where there may be very little constitutional disturbance and scarcely any local pain, the thermometer often rises to 101° or 102°, and it is a curious fact, repeatedly verified by observation, that even where a patient is so far recovered as to resume her occupations, the temperature, if taken at night, is often maintained one degree above the normal measure so long as any inflammatory deposit remains unabsorbed.

If suppuration takes place there is commonly an exacerbation of symptoms. When the case has been acute from the first the more active symptoms may have perhaps subsided for a while; but now there is a reaccession of shooting pains, with pyrexia, and these probably preceded by a rigor. When the case is chronic and sluggish in type, the occurrence of suppuration may be indicated by the supervention of pseudo-acute symptoms. Eventually the establishment in both cases of recurring signs of hectic, with the facial expression characteristic of the formation of pus, afford strong presumptive evidence of its occurrence even when this cannot readily be verified by physical examination.

The chief physical characteristics of tumor formed in the progress of pelvic cellulitis and peritonitis are, as previously pointed out, *irregularity*, *hardness*, and *immobility*. The stage of partial softness or elasticity is commonly so short as rarely to be recognized. If sufficiently large the swelling is felt above the brim of the pelvis by external examination; but more frequently it is limited to the deeper parts of the pelvic cavity, and internal exploration is required for its detection. The amount of inflammatory deposit indeed varies greatly. Sometimes it is only just enough to produce slight swelling and hardness on one border of the uterus, or to glue the uterus posteriorly and interfere with its mobility. Again, hardness and immobility without much sense of tumor may be confined to the roof of the pelvis, and give the impression of a thin plastic layer having been poured over the surface of the pelvic organs which has hardened there, fixing the uterus to the surrounding parts. This is characteristic of a pure form of pelvic peritonitis. At other times the exudation is so considerable that it fills the posterior half of the pelvis and pushes the whole uterus forward against the symphisis pubis. When swelling is circumscribed to the cul-de-sac of Douglas, it pushes the cervix uteri forwards and upwards, as in retro-uterine hæmatocele, the fundus being more or

less retroverted. This displacement may be to such an extent that it is difficult to reach the os uteri. If formed in the lateral aspects of the pelvis it displaces the uterus over to the opposite side, and probably raises it towards the iliac fossa. When the tumor is large enough to reach above the pelvic brim, it will in some instances be found that its upper part consists of the fundus uteri pushed forward and upward by the inflammatory exudation in the lower and posterior parts of the true pelvis; and again it should be remembered that in other cases where the tumor attains large dimensions in the abdomen, it is formed in part at least by matting together of the intestines as the result of peritoneal exudation.

Whatever the amount or position of the inflammatory effusion, its tendency is to fix and unite the pelvic organs, and render any attempt to change their position with the finger impracticable. Some few cases only have been observed in which tumors of this kind have been more or less movable. These were of very limited size, and generally limited to Douglas's cul-de-sac. In acute cases the parts are so tender that only the gentlest vaginal examination is tolerable. The genital passage feels hot; its arteries pulsate unduly, and occasionally the vagina is narrowed and distorted by the surrounding swelling impinging on its walls. If an examination be made by the rectum the results found on vaginal exploration are confirmed. The surrounding structures are fixed and immovable, and the rectum is probably compressed by the tumor which lies between it and the uterus.

Whenever possible, external and internal examination should be combined, as when careful exploration is made of other pelvic tumors. In this way the size of the swelling may be best determined, and a distinction may be drawn between mere hardness or fixation and genuine tumor.

When suppuration has occurred fluctuation may not at first be readily detected. In some patients all the constitutional signs of suppuration are present, and yet the most practised touch fails to find any indication of softening in the accessible portions of the inflammatory tumor. Occasionally a pelvic abscess bursts into the intestine too high up to be reached by the exploring finger. In most cases, however, when abscess has formed, a softened or doughy feeling becomes eventually perceptible, in some part of the parietes, on examination either by the vagina or rectum, or external surface of the abdomen. In cases of doubt Sir James Simpson proposed to push a fine exploring trocar in the inflammatory tumor for the detection of pus; but this should only be resorted to when the general symptoms are urgent and threatening, and not merely for the purpose of confirming a diagnosis.

When evacuation of the abscess takes place an amelioration of all the symptoms usually follows, and the improvement in the condition of the patient progresses, unless purulent matter is contained in several separate loculaments, and the first discharge proves to be only the bursting of one of a series of separate abscesses. In this case only partial relief is afforded, and the hectic symptoms are repeated until all the abscesses are emptied.

Different estimates have been made as to the frequency with which suppuration takes place in proportion to the entire sum of cases of pelvic inflammation. M. Grisolle states that out of 73 cases he had collected, resolution took place only in nine. Sir J. Y. Simpson held that suppuration occurred only in about half the cases. The value of M. Grisolle's statistics in aiding to form a general estimate is impaired by the fact that his cases were chiefly those in which inflammation was confined to the iliac fossa, and where causes other than those implicating the genital organs were concerned. More recent statistics tend to prove that suppuration is certainly more frequent in cases following delivery and abortion, than under other circumstances. Dr. McClintock gives the frequency of suppuration in post-puerperal cases at 37 in 70, and Dr. West at 51 in 100.

In the non-puerperal state, termination by resolution is the rule, and M. Gaillard places the frequency of suppuration under these circumstances at only 4 in 53 cases. The frequency of inflammation and abscess as affecting relatively the two sides of the pelvis has been an object of interest to investigators, and the estimates of various authors show great disparity. Taking the sum of cases recorded by Grisolle, Bourden, and Marchal de Calvi, the frequency is nearly double on the left side. In Gaillard's cases the preponderance was on the right, while in Dr. M. Duncan's cases, the frequency on the two sides was equal.

Although the opening and discharge of a pelvic abscess, commonly brings relief to the more urgent symptoms and convalescence progresses steadily afterwards; yet in exceptional cases the cavity of the abscess, instead of granulating up and being obliterated, becomes lined with a distinct pyogenic membrane, and although, perhaps, much contracted, continues to secrete pus for weeks or months after the first exit, through fistulæ which open either externally, or into some pelvic viscus. These pelvic fistulæ, by persistence, cause much discomfort, and at times become a serious drain on the strength of the patient. Simpson has recorded an instance in which chronic fis-

tulous openings existed in the vagina, groin, and thigh, and it was found by injection that all communicated with each other. Whether a case terminates by resolution or suppuration, if there has been any considerable amount of lymph deposit during the progress of the affection, there will usually be indications of thickening to be found in the pelvis long after the subsidence of the attack, and the adhesions contracted among the various pelvic organs may be detected months after the patient is to all appearance perfectly well.

Diagnosis.—The diagnosis is not ordinarily surrounded by any great amount of difficulty. From puerperal fever and general peritonitis, these affections may be distinguished by observing, as the attack progresses, the distinct localization of the symptoms, and the less severe character of the constitutional disturbance. In the later stages it is almost impossible to discriminate between the results of pelvic inflammation and hæmatocele, the local manifestations in both at certain periods of progress being almost identical. A careful inquiry into the history will, nevertheless, do much to clear up the differential diagnosis. In hæmatocele the attack is commonly developed during, or about, the time of a catamenial period, which probably is unduly profuse, showing a tendency to hemorrhage, or else it is suddenly suppressed; the tumor is formed suddenly, and, if large, is accompanied with indications of anæmia, on account of the mass of blood which has escaped from the general circulation. The tumor again is most soft and fluctuating from the first, and hardens as time goes on. Lastly, the signs of local inflammation and of general febrile disturbance supervene after the formation of the tumor. On the other hand pelvic cellulitis and peritonitis most frequently succeed delivery and abortion; the tumors they form come slowly in comparison, are hard from the first, and may or may not soften in their later stages; local pain and febrile excitement distinctly precede the development of tumor.

The hardness and immobility produced by pelvic inflammation has repeatedly been mistaken for malignant deposit about the uterus and its appendages. The latter may be distinguished by noting that the symptoms have, probably, not followed parturition or abortion; have not been preceded by, nor are accompanied by, febrile action; that they are evidently an extension from an uterus affected by cancerous ulceration—the cervix being sound in most cases of pelvic inflammation. If further evidence is needed, the subsequent progress of the affection and the development of general cachexia leave no further doubt of the nature of the case, and it is always wise in doubtful cases to suspend an opinion until time clears up the difficulty. Ovarian and fibroid tumors may be diagnosticated by their slow growth, definite form, the non-occurrence of febrile symptoms, and generally by the absence of fixation; retroversion or flexion of the uterus in the unimpregnated condition by the use of the sound—in the gravid state by the general and local signs of pregnancy.

Great difficulties beset the diagnosis when a small ovarian or fibroid tumor, or a retroflexed uterus, is bound down by inflammatory adhesions and deposit in the posterior cul-de-sac; and the difficulty is the greater if inflammation is then in progress. In the case of retroflexion, a sound will indicate the direction of the uterine cavity when it can be safely used—although it may be impossible to replace the womb. When a small ovarian tumor is the centre of inflammatory deposit in the posterior part of the pelvis, its outline will become more sharply defined as time progresses, and it may probably be remarked, as the indications of inflammation subside, that a certain elasticity becomes apparent to touch, which presumably is not due to the softening of suppuration in the absence of the usual preceding signs of suppuration.

Extra uterine fœtation is to be distinguished by observing the previous signs of pregnancy, and the general progress of the case. The rupture of a tubal fœtation approaches nearer in its general symptoms to pelvic hæmatocele than to cellulitis or peritonitis. Fecal accumulations cause frequent mistakes, and may, unless care be taken to secure a free evacuation of the bowel before examination, be erroneously taken for masses of inflammatory thickening. The diagnosis between abscess forming in the pelvis as the result of caries in the vertebræ, of the bones of the pelvis, or originating in connection with some part of the intestinal track, must be made out by the antecedent and general symptoms of these conditions detailed in their own place.

M. Bernutz and Dr. Thomas have attempted to discriminate between the signs, both general and local, of pelvic cellulitis and pelvic peritonitis. Dr. Thomas indeed has published an ingeniously drawn up table of differences. Practically however it will be found that only in some few typical and rare cases are the symptoms and physical signs so dissociated as to enable the practitioner to say this is pure peritonitis and that pure cellulitis. The signs of one affection may predominate over the other, and give a type to the case, but in most instances the same symptoms answer for both, and rarely does the one form of inflammation occur

without being complicated with, and merging more or less into the other. The chief points of difference dwelt upon by these authors are first, that the tumor is generally confined to the true pelvis in the case of peritonitis, but can commonly be felt reaching from the broad ligament to the pelvic brim and iliac fossa in cellulitis. In the peritoneal tumor there are more or less distinct and hard prominences to be felt by the vagina, in the direction of the cul-de-sac; while the tumor is smoother and more lateral in position in cellulitis. Suppuration is rare in the peritonitic form, frequent in cellulitis. The uterus is always displaced to the opposite side, even when it is immovable, in pelvic peritonitis; not necessarily displaced, and interference with its mobility less marked, in cellulitis. Retraction of the thigh is rare in peritonitis, common in cellulitis. Constitutional signs of peritonitis are present in the one case, not in the other.

There is no assured method of distinguishing the serous collections of fluid from those of pus when occurring in the course of these affections without the aid of the exploring needle, which it may not always be expedient to use. The exploring needle may nevertheless be advantageously employed previous to evacuation which this operation seems called for, and a doubt remains concerning the nature of the swelling.

The Prognosis is generally favorable, but the duration is uncertain and variable, and the complications and perils are numerous. A large number of cases terminate by resolution, and if in these instances the symptoms are slight and the results do not go beyond the effusion of serum or soft plastic exudation, the patient soon recovers and the swelling speedily disappears. When exudation is extensive and dense, and there is much fixing of the pelvic organs, convalescence will be more tardy and the results will pass more slowly. Thus a patient may continue in feeble health and with impaired powers of locomotion for a considerable time. In these cases swelling and hardness may be found in the pelvis on examination for an unlimited period, and the fixed condition of the uterus interferes with the performance of its functions. Menstruation is rarely altogether arrested, but pregnancy with a fixed uterus is not very likely to take place; and even if conception does occur, there is proclivity to abortion, because the expansion and rising of the uterus are interfered with during its development. The tendency of plastic exudation and of adhesion in the pelvis, however firm, is no doubt to disappear in the progress of time, like the adhesions formed in the pleura and elsewhere, and repair effected in this way is sometimes very remarkable. In some examples, nevertheless, the fixed condition becomes permanent and irremediable, and hence it happens not unfrequently that operations about the uterus followed by pelvic cellulitis and peritonitis leave such results that the reproductive apparatus is permanently maimed. It may be stated as a general proposition in reference to puerperal cases, that the prognosis is graver both in pelvic peritonitis and in cellulitis than in the non-puerperal condition, and further, the danger is the greater in proportion as peritonitis is the more predominant, inasmuch as there is then great tendency of inflammation to spread to the general abdominal cavity, and parturient women ill bear inflammations of serous membranes. Again, the formation of abscess occurs more frequently in association with puerperal cellulitis than under other circumstances, and brings its own perils.

Fortunately most patients in whom pelvic inflammation runs on to abscess incur little risk of a fatal termination, unless suppuration is very extensive or prolonged or other complications are added. Evacuation takes place either by spontaneous or artificial opening, and recovery follows. The dangers which beset such cases are of exceptional occurrence and can often be averted by judicious treatment. The sources of danger are first, that occasionally pelvic abscess bursts into the cavity of the peritoneum, and this is almost inevitably followed by collapse and death. The danger of this catastrophe is always greater when the abscess is intra-peritoneal, because the cavity is necessarily formed in some part of its extent by false membranes of little resisting power. Dr. McClintock, without distinguishing between pelvic cellulitis and peritonitis, avers that the danger of bursting into the peritoneum is greater in the non-puerperal than in the puerperal forms of pelvic inflammation. He records three cases occurring in non-puerperal patients, and had never seen a similar result in abscess succeeding to parturition.

Secondly, in cases where suppuration has been established and evacuation has taken place, the safety of the patient is sometimes jeopardized by the extent of the suppuration and its persistence. The non-contraction of a pelvic abscess after bursting and the continued discharge of pus for a prolonged period, through fistulæ, which may be single or multiple, and perhaps so inaccessible as not to be amenable to treatment, may eventually wear out the strength of the patient or develop tubercular disease. This form of peril becomes more prominent where fis-

tulæ communicate with the colon or rectum and keep up an exhausting diarrhœa or dysentery, over which remedies have little control. Moreover, when suppuration is so extensive it often destroys the ovaries, renders the Fallopian tubes impervious, and possibly permanently displaces the uterus, thus irreparably damaging the reproductive apparatus, and arresting or disturbing its functions.

Thirdly, the occurrence of suppuration may be the occasion of septicæmia, and the patient may develop all the symptoms of general blood-poisoning.

Fourthly, cellulitis sometimes—but pelvic peritonitis more frequently—has a tendency in certain patients to assume a chronic type, and to take the form of repeated attacks, which may be determined by the occurrence of each catamenial period. In women so predisposed there is always a likelihood of tubercular peritonitis being set up, and the impaired nutrition and emaciation favor tubercular growth in the lungs and other organs, and thus the patient eventually dies of phthisis. If reference be made to the article on pelvic hæmatocele it will be seen that pelvic peritonitis is often the precursor of hæmatocele. MM. Tardieu, Bernutz, and others have carefully studied the relations between these two affections, and Virchow and Herber suggest the possibility of capillaries being formed in false membranes over the pelvic peritoneum and being the source of bleeding in such cases.

Lastly, sources of suffering and danger now and then present themselves in a less definite form, and on this account are more embarrassing to the medical practitioner. Chronic induration and deposit in the pelvis—in or outside the peritoneum—may become the seat of severe neuralgic pain, which increases with the feebler condition of the patient, and comes on in worse paroxysms as night approaches. The demand for opiates in some form or other, and in augmenting doses, increases, until it becomes doubtful whether the physical suffering of the patient or her morbid craving for the narcotic is the more formidable evil. In the mean time digestion and nutrition become impaired, the temper irritable and the mind enfeebled, and the patient either becomes a chronic invalid or dies of some form of tuberculosis. Further, if the ovaries are involved in chronic exudation, nausea and sickness are often added to the discomforts and perils of the patient, particularly at the menstrual periods; and in cases where inflammation, acute or chronic, extends to the bladder, the additional suffering so entailed, with the exhausting muco-purulent discharge from its mucous membrane, cannot fail, if prolonged to be sources of danger.

Treatment.—The treatment of pelvic-cellulitis and of pelvic-peritonitis is the same as that for inflammation of the pelvic and abdominal viscera generally. In the acute form general blood-letting is now rarely practised, but leeches in moderate numbers, according to the urgency of the symptoms and the strength of the patient, may be applied without hesitation. They may be applied over the seat of pain, if this is above the pelvic brim; but perhaps in all cases more relief will be experienced when they are applied to the perineum or round the anus, than elsewhere, because there the vessels anastomose most freely with those involved in the inflammatory action. It is rarely advisable to apply leeches to the cervic uteri in acute cases, because the pain and tenderness preclude the use of a speculum or leeching-tube. Three or four leeches will commonly be sufficient, and at most five or six. The leeches may be repeated if necessary at longer or shorter intervals, but in the abstraction of blood even by leeches it is needful to bear in mind that the patient when attacked is probably in a depressed condition of health, and at the beginning of what may prove to be a protracted illness; hence much depletion may be a serious disadvantage later, and retard recovery. Light linseed poultices moistened with liniment of belladonna or laudanum, and kept constantly applied over the hypogastrium, afford much relief to pain; or when the weight of a poultice is ill borne, spongiopiline may be used as a substitute. It is well to avoid all purgative medicines and to keep the bowels quiet during the continuance of acute symptoms, and opiates in some form will be required to fulfil this indication and at the same time to relieve pain. Although much has been said and written against the employment of mercury, there is probably no series of cases in which its judicious administration in the early stage brings such obvious advantages as in those now under consideration. In combination with opium it seems to act as a direct sedative to inflammatory action, to lessen the tendency to plastic exudation, and to promote absorption when progress abates. With these objects calomel may be given in one or two-grain doses every four or six hours combined with half a grain of opium, and if more opium be required it may be given at night, separately, either by the mouth, by suppository, or enemata, or by hypodermic injection.

Dr. M. Duncan prefers gray powder or blue pill, combined with Dover's powder or solid opium, to calomel and opium, which he has found to cause severe purging; but this disadvantage may, in most cases, be avoided by not giving too large doses of calomel.

In the lower forms of inflammation, particularly those which take a diffuse form, and are characterized by want of power, it is better to avoid mercurials and depletion altogether, and to trust to opiates alone; and in no case where mercury may be employed, should it be pushed to salivation, although the course may be repeated in case of relapse. If for any reason it is inexpedient to give opium in any of its forms, hydrate of chloral with henbane, belladonna, Indian hemp, or iodoform may be substituted, but none of these hypnotics are so trustworthy as opium or morphia.

Absolute rest in the recumbent posture should be enjoined, and the patient placed in the attitude which gives greatest ease. The extremities should be kept warm, and the diet should be unstimulating, consisting of milk, beef-tea, and simple farinaceous articles. If there be marked general feverishness, salines, such as the acetate of ammonia or citrate of potash, may be given with small doses of aconite in the intervals of the doses of the mercurial with opiate, and if sickness is present, the saline may be prescribed in an effervescing form. Demulcent drinks, barley-water and toast and water, potash and seltzer-water may be permitted to relieve the thirst of the patient, and when bladder symptoms are troublesome, the decoction of *triticum repens*, recommended by Sir H. Thompson, may be prescribed. When vomiting is especially distressing it may be necessary to suspend other remedies for a while, until the stomach grows less irritable. To favor this quiescence small doses of hydrocyanic acid, either in effervescence or with carbonate of bismuth, or small doses of opium, or belladonna may be given. Sinapisms and blisters to the epigastrium have been found useful in some obstinate cases, and hypodermic injection of morphia combined with atropine has succeeded when other means have failed. In all such instances food must be given in most sparing quantity often repeated. Stimulants, even sparkling wines, are often hurtful; while ice with milk is retained and is grateful. Where even the simplest things are rejected, there is no alternative but to give nourishment by enemata.

When the sharper symptoms have abated, Dr. Gaillard Thomas strongly recommends the application every ten or fourteen days of a cantharides blister, four or six inches square, over the hypogastrium, as the most rapid and efficient remedial agent for promoting the removal of the exuded lymph and preventing the occurrence of suppuration. Valuable as such means may be, caution must be exercised in their employment, as in some sensitive women there is no doubt that cantharides blisters over the lower part of the abdomen provoke distressing and persistent strangury. When well borne by the patient there can be no doubt that blisters secure a more rapid improvement in the chronic and tedious forms of these affections, and to keep up a continued effect a small part of the blistered surface may be kept permanently open by dressing it with the French tissue-plasters known as "Albespeyres." Another method of producing counter-irritation which is free from the inconvenience of cantharides blisters, and may be used for a long period, is the painting over the surface above the pubes, once in twenty-four hours, with tincture of iodine; or, if thought desirable, equal parts of iodine and mercurial ointment may be applied instead. At this stage of the affection the bowels should be carefully regulated, and an occasional purge may be given if necessary; the diet should be somewhat improved, and the calomel and opium discontinued. If required, opium may be given alone, and the doses be at distant intervals. Instead of the febrifuge remedies, suitable doses of bromide or iodide of potassium with bitter infusion may be substituted three times a day; and if there is no great tenderness of the vagina, a warm douche may be used night and morning, —the injected water being slightly medicated with tincture of iodine or iodide of potassium, as recommended by Dr. Thomas. At no stage of the affection should the patient be allowed to quit the horizontal posture until movement can be effected without pain, and even when apparently convalescent, to prevent relapse, continued care and repose must be observed for two or three months afterwards at the return of each catamenial period. It has repeatedly been noticed that women who have left the hospital to resume their occupations apparently convalescent, are apt to have a reaccession of their original symptoms, and to seek readmission within a very short period. When indications of suppuration have shown themselves, either in the acute or chronic form, all forms of depletion, and all remedies which may possibly impair the strength of the patient, should be discontinued and a more tonic method generally should be pursued. With the first local or general signs of the formation of pus in the acute form, fomentations and poultices should be more sedulously applied to the lower part of the abdomen, and in the chronic type, where they have not previously been thought necessary or have for a time been discontinued, they should at once be brought into requisition. To envelop the whole pelvis in a large linseed poultice often gives the most marked relief to the suffering associated with this stage, and poultices may be aided if necessary by the

local application of sedatives, or by sedatives given internally. These, with perfect rest and a careful regulation of a simple nutritious diet, attention to the state of the bowels, and generally to the various points in the management of the sick room, which so much conduce to the well-doing of all chronic invalids, comprise the treatment until abscess has formed.

Concerning the propriety of opening pelvic abscess there is considerable difference of opinion. The proper rule for practice, according to some authorities, is to evacuate the pus as soon as there is distinct evidence of its formation, or at least so soon after its formation as it is accessible to surgical procedure. By early opening, it is urged, the pain and irritative fever are cut short and cure is expedited. At the same time the danger of spontaneous openings taking place into the peritoneum or other inconvenient locality will probably be averted. M. Becquerel, on the other hand, goes so far as to assert that the abscess should never be opened artificially, and M. Aran affirms there is no evidence that artificial evacuation at one point prevents openings in other situations.

In truth there is no universal rule for practice in this matter. As in purulent collections forming elsewhere, the expediency of making an opening must be determined by the urgency of the symptoms, by the progress and duration of the case, by the accessibility to puncture, and by the probabilities of early spontaneous evacuation taking place. It is obviously undesirable to operate before the abscess is mature, or when it is so deep-seated as to render puncture hazardous and uncertain in result. In most cases spontaneous evacuation will take place at the best possible time and in the locality, considering all circumstances, sufficiently favorable without the intervention of the surgeon, and general treatment and local palliatives will only be required. When, however, the local and constitutional symptoms are such as to cause anxiety; when, for example, pain is severe and constant, or when it returns in periodic paroxysms which entail much suffering; when irritative fever, colliquative diarrhœa, mucous membrane irritation,—as evidenced by stomatitis or sympathetic vomiting,—become so pronounced as to threaten serious exhaustion, then it becomes an obvious duty to promote as speedy an evacuation as may be possible.

Artificial opening may with less hesitation be undertaken, if pus is felt near the surface, either externally or internally, and fluctuation is distinct. Where it is deeper seated, and local examination is unable with sufficient precision to confirm the evidence of pus formation offered by the general symptoms, the use of the exploring needle suggested by Sir James Simpson may first clear up the doubt, and be followed by a wider opening. Often when a pelvic tumor has felt hard and inelastic, when the most careful *tactus eruditus* has failed to detect fluctuation, notwithstanding the general history of pelvic abscess, pus has been found to be present on puncture, and the deceptive hardness has been due to the great distension, and the thickened indurated condition of the cyst wall. In doubtful conditions of this kind the exploring needle or a fine trocar becomes an important aid both to diagnosis and as a preliminary to operation.

In operating, a Poiteau's trocar or guarded bistoury may be employed, but the bistoury is to be preferred, as the aperture thus made is wider and less likely to close before the whole of the purulent matter is discharged, than when a trocar is used. The puncture must necessarily be made where fluctuation is most distinct, or where there is most probability of reaching pus, always supposing that no special dangers are incurred in the locality so indicated. A careful examination must be made before puncture to ascertain that no considerable artery pulsates in the line of the proposed incision. When pus has once obtained egress there is no necessity to break down partitions or to inject water into the cavity of the abscess, as some have recommended. In abscess formed as the result of pelvic peritonitis, these procedures would in fact incur the peril of breaking down adhesions, which are the fragile safeguards against direct communication with the general cavity of the peritoneum.

When a choice is afforded of locality for incision, the general integument on the surface of the body is to be preferred. If the abscess is opened internally, the vagina is to be preferred for reasons previously stated, and the genital canal should then be gently washed out by some weak disinfectant injection once in twelve hours; more especially should this be done if the discharge is offensive in character.

The incision must nevertheless be made wherever the abscess is most easily accessible, and where its contents can most readily drain away after the operation.

In chronic abscesses which go on accumulating pus and repeatedly discharging, it may be necessary to use a drainage tube to secure a continuous escape of fluid.

For the treatment of persistent fistulæ the reader may be referred to Sir J. Y. Simpson's works.

The treatment of complications and general after treatment of patients who have been the subjects of pelvic abscess is identical with that which is appropriate for patients who have suffered from

suppuration in other localities, and the various forms of persistent induration left as the sequelæ of pelvic cellulitis and peritonitis require the same measures as those prescribed for the chronic forms of uterine hypertrophy which are described elsewhere.

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INFLAMMATION OF THE OVARY.

By John Williams, M.D.

Inflammation of the ovary occurring during the puerperal period will not be considered in this place.

Inflammation of the ovary in the unimpregnated female is not of infrequent occurrence. It rarely terminates fatally, and consequently opportunities seldom offer for the verification of the diagnosis or for observing the changes which take place in the organ in the course of the disease; yet the evidence obtained by clinical observation and by examination made after death leaves no doubt of the correctness of the general belief in the frequency of this affection. As the disease rarely proves fatal and the post-mortem proof of its existence has to be sought in subjects who have perished from other causes, and in whom the previous existence of ovaritis had not been suspected or inquired into, and whose menstrual history was not known, the only evidence of the frequency with which ovaritis occurs which can be expected to be obtained is the presence of fibrous bands or adhesions between the ovary and neighboring organs, of thickening and opacity of the peritoneum covering the ovary, of the

walls of the Graafian follicles, and induration of the ovarian stroma. Such conditions are by no means uncommonly met with. On account of the rarity of opportunities of examining the ovaries during an attack of inflammation, I will quote a description of an inflamed ovary found by Scanzoni in the body of a patient who died of pneumonia. He says: "The autopsy showed in the pelvis to the right of the uterus, a mass of coagulated fibrin of the size of the fist, easily separated from the adjacent organs, and evidently the result of an effusion. Having removed this, we came upon the ovary, which had a longitudinal diameter of 2·16 inches, a transverse diameter of 1·57, and a thickness of about 1·37 inches. Its form was oval, and it was considerably enlarged, as the measurements show. Its surface was of a violet-bluish color, covered by numerous distended veins, and towards the inner angle of the posterior surface a recently ruptured follicle having a reddish-black color was detected. The consistency of the organ was soft, in some parts almost fluctuating. On cutting into it there escaped a considerable amount of blood, and the surface of the section presented a violet color and some greatly distended veins. The vesicle just alluded to as showing where a rupture had recently taken place, was about the size of a pea. It still retained in its centre a small quantity of black liquid blood, while its sides were coated by a tolerably thick lining of fibrin. Two neighboring vesicles presented nearly the same measurements to the eye, and caused a slight protuberance on the surface of the ovary. On opening them, a fluid composed of blood and serum was poured out. Towards the other extremity of the ovary, where the congestion was less marked, the section less red, and the consistency firmer, an abscess was discovered in the parenchyma itself about the size of a bean, and containing pus mixed with blood. Behind this somewhat large abscess other smaller ones were discovered, whose size varied from that of a millet-seed up to that of a small pea. These were situated deeply in the parenchyma, and all contained more or less blood and pus. The entire tissue was infiltrated with serum, and most of the vesicles were perceptibly enlarged by a too copious accumulation of fluid."

In this instance the whole tissue of the organ was affected—the peritoneal covering, the Graafian follicles, and the stroma.

Four degrees of ovaritis have been described. In the first the organ is but slightly enlarged, its substance, though softer than natural, is firm, red, and injected, and the Graafian follicles increased in size. It is a state of congestion, and one that has repeatedly been observed, but only as a physiological condition in women who have died during or about a menstrual epoch. Though it must be admitted that congestion is, in the ovary as well as in other organs, the first stage of inflammation, yet owing to the difficulties with which the investigation of the anatomy of ovaritis is surrounded, and to the peculiar changes which take place in the organ in the performance of its functions, the first stage of ovaritis has never been observed in the dead subject. The second stage is that of red softening. The organ is enlarged to two or three times its usual volume; its tissue is soft and friable, is infiltrated with serum, and presents here and there small hemorrhages. In the third, points of pus appear in place of the hemorrhagic spots; these are usually found in the vesicles, but are also met with in the stroma. In the fourth degree softening and suppuration take place, and the ovary may be converted into an abscess, or break down into a sanious mass, as was observed by Kiwisch. The last stage is very rarely reached in the unimpregnated state. The second and third are analogous to the red and gray hepatization of pneumonia, and have been observed in the same organ as was the case in the instance quoted from Scanzoni.

It is believed that each of the tissues of the ovary may be affected separately by inflammation, and three kinds of ovaritis have consequently been described—ovarian peritonitis, inflammation of the Graafian follicles or vesiculete of Negrier, and inflammation of the parenchyma. Ovarian peritonitis occurs frequently, as is proved by the adhesions found so often after death between the ovary and the neighboring organs; whether the inflammation is limited to the superficial covering of the organ or extends for some depth into the stroma is uncertain. It usually extends to the peritoneum in the neighborhood, though it does not become general.

Inflammation may attack one or more of the Graafian vesicles. The walls of the affected follicles are injected, red, and softened; their contents become turbid, bloody, or purulent. It may result in atrophy of the follicles, give rise to the formation of cysts, or run on to suppuration and abscess. When several follicles are affected, the intervening stroma becomes soft, œdematous, and friable: when suppuration takes place, the stroma between the several follicles breaks down and the ovary may thus become converted into a purulent sac.

Inflammation of the parenchyma is rare in the unimpregnated state. The ovary becomes enlarged, as already described. It occasionally ends in suppuration; more often it results in an excessive

formation of fibrous tissue, which gives rise to permanent enlargement and induration of the organ, and atrophy of the follicles.

Abscess of the ovary may terminate in various ways. It may open into the peritoneum and cause death rapidly by shock, collapse, or general peritonitis; or a small quantity only of pus having escaped, may lead to circumscribed peritonitis and become encysted; or it may communicate with and discharge its contents into the bladder, rectum, or vagina; or, lastly, it may make its way through the abdominal walls and discharge on the surface.

Inflammation of the ovary is rarely, if ever, uncomplicated: there is present in addition inflammation of the Fallopian tubes and of the neighboring peritoneum and organs. The acute form of the affection is very rare apart from childbed—so rare that many practitioners of the largest experience have not seen a single instance of the disease.

Its causes are exposure to cold during menstruation, excessive sexual indulgence, extension of inflammation from neighboring organs—the uterus, Fallopian tubes, and broad ligaments,—gonorrhœa, operations on the uterus, the use of instruments, as intra-uterine stem pessaries, and intra-uterine injections: acute fevers.

Slavjansky states that inflammation of the follicles is not uncommon in the course of acute febrile diseases.

The form of ovarian inflammation usually met with, and which is very common, is chronic ovaritis. It may follow the acute or may arise independently of it; or it may result from the same causes which give rise to the acute form. By far the greater number of cases, however, may be referred to two classes—those which follow labor without apparently an acute stage, and those which are associated with dysmenorrhœa.

In the first class labor may have been perfectly normal and easy, or protracted and difficult; the woman apparently makes a good recovery, and suffers from no untoward symptoms until she leaves her bed. At that time or some time after a pain is felt in the region of one of the ovaries—usually the left; this may be at first slight, but is aggravated by walking or exertion. In the course of months it becomes more severe.

In the single, chronic ovaritis is in the very great majority of cases associated with dysmenorrhœa. Menstruation—which may be regular or irregular—is from the first associated with pain. The pain is in the back and pelvis, and continues to return at or about the menstrual epochs, ceasing during the intervals, for several years. After a long period a new and different pain is experienced; this is situated in the ovarian region and goes through to the back, and is due to ovaritis.

What may be the exact relation between the dysmenorrhœa and ovaritis is uncertain. It may be that the inflammation with which the inner surface of the uterus is affected in most of these cases, extends along the Fallopian tube until it ultimately reaches the ovary; or it may be that absorption of products of menstruation retained in the uterus takes place, and that the ovaritis is really septic in character. Whatever be the nature of it, the sequence of events mentioned is extremely common.

Syphilis is said to be a cause of ovaritis.

Phthisis and scrofula predispose to the disease.

The only case of abscess in the ovary seen by me was in a scrofulous patient. She died of acute peritonitis. Examination of the body showed the peritonitis to be due to bursting of a small abscess in the ovary. There was scrofulous disease of the kidneys.

The symptoms of the acute form are similar to those of pelvic cellulitis and peritonitis; and the intimate relation between these affections renders the diagnosis of ovaritis generally impossible. There is severe pain in the region of the affected ovary, some tympanitic swelling, and great tenderness on pressure, fever, and often a rigor. Examination by the vagina or rectum will discover the ovary enlarged, depressed, usually behind and on one side of the uterus, and exquisitely tender. If it be complicated with peritonitis, cellulitis, with effusion of lymph into the peritoneal cavity or with effusion into the cellular tissue, the enlarged ovary will not be detected. In rare cases the disease proves rapidly fatal by extension of the inflammation to the peritoneum generally, by suppuration and rupture of the abscess, or by rapid destruction of the ovarian tissue. On the other hand, resolution and recovery may take place, or the inflammation may become chronic.

In the treatment absolute rest is essential. The patient should be kept in bed. If seen early it may be advisable to apply ten or twelve leeches to the epigastrium. Hot poultices or fomentations should be frequently applied to the lower abdomen, and opium should be freely administered.

In chronic ovaritis pain is felt in the region of the affected ovary. This radiates to the back and hips and down the thigh on the same side. It is of a dull or sharp character, and is at first periodic, lasting for a few days only at or about the menstrual epochs. After a time it becomes continuous, there are no intervals of freedom from suffering, and it is aggravated by walking and standing. There is often frequent micturition, and defecation is in some instances exquisitely pain-

ful. Menstruation may be scanty, moderate in quantity, or profuse; sometimes there is amenorrhœa.

When the disease is of long duration, nervous symptoms set in. Curious sensations are felt in the side affected. These are not necessarily limited to any one spot, but are experienced over the whole of that half of the body. The patients become hysterical and often confirmed invalids. On examination of the abdomen one ovarian region is found fuller than normal—the fulness being due to flatus. Patients often say they have a swelling in that situation, and believe themselves to be the subjects of a tumor.

The part is tender, especially on deep pressure. Bimanual examination, made with one hand on the abdomen and a finger of the other in the vagina or rectum, will in most cases discover the ovary enlarged and tender. The organ is often but not always prolapsed, and occupies a position behind and a little to one side of the uterus. Pressure on it causes severe pain, and in some cases nausea. There is no marked fever, though there are often slight febrile attacks. The digestive functions are impaired. The tongue is furred, and the appetite lost; the bowels obstinately confined. Sterility is often present, especially in women who have not borne children, and who are the subjects of chronic ovaritis. Sterility is far less common in women who have acquired ovaritis after labor.

The disease very rarely proves fatal; it is, however, one of long duration. The chief danger lies in the liability to peritonitis. Both acute and chronic ovaritis are diseases of the reproductive period of life. The chronic form which follows labor is far more tractable than that associated with primary dysmenorrhœa. I do not think I have seen a case of the latter kind cured while the uterus and ovaries continued to perform their physiological functions.

Rest is an important element in treatment. Physical rest may be readily obtained, but physiological rest is not possible during menstrual life. Bromide of potassium is said to be useful, but I cannot say I have seen any good results from its administration, except when given in large doses at bedtime for three or four nights in succession before a menstrual epoch. Better results are obtained by general treatment and counter-irritation over the painful ovary. The bowels should be kept open by salines; sulphate of magnesia and soda are the best. They should be given three times a day, and the dose regulated so as to obtain one or two free actions daily. Purgation should be avoided. Blisters, or a liniment of iodine applied to the ovarian region, relieve the pain. The relief, however, is often only temporary. The production of an eschar or ulcer on the cervix of the uterus by the application of potassæ c. calce is said to be of service. In some cases relief is obtained by wearing a Hodge's pessary. This is doubtless due to the action of the pessary in keeping the ovary and uterus at rest. It will be found that the above means will effect a cure in a great many cases, more especially in those in whom the ovaritis can be traced back to labor; while in the majority, if not in all, of those in whom the ovaritis is dependent on primary dysmenorrhœa no means will be found to effect a cure, and the most we can hope to do is to arrest the course of the disease or ward off the onset of those nervous symptoms which mark it in its later stages and which render the patient a complete invalid.

[*Prolapsus* of one or both ovaries is of not very infrequent occurrence. During the menstrual *nisus*, there is evidence of a physiological turgescence of the ovaries; and this causes their descent to a lower position. When the abdominal and pelvic parietes are relaxed, or the normal periodical ovarian erethism becomes converted into a chronic congestion, the organ or organs may continue to be displaced.

Causes of this affection appear to be: imperfect return of the abdominal and pelvic walls to their normal condition after parturition; sympathetic engorgement of the ovaries in connection with chronic metritis or "irritable uterus;" sterility, or frequent, incomplete, and unfruitful sexual intercourse; excess in venereal indulgence; and masturbation.

Sometimes the ovary descends into an inguinal, or, more rarely, an umbilical hernia. The symptoms are, pain in walking, and still more at the time of defecation; sometimes, pain whenever the rectum is occupied with feces; pain in the act of coition; and attacks of pain in one or both groins, according to the single or double nature of the dislocation. If one ovary alone descend, it is generally the left.

By digital examination, the displaced ovary may be felt, on one side of the uterus; pressure upon it causes a sickening pain, like that produced in a man by pressure upon a testicle.

Dysmenorrhœa is a common accompaniment of ovarian prolapsus; and so is menorrhagia. Lowness of spirits very often attends it.

In the treatment of this affection, Dr. Goodell[1] advises the daily use, for a con-

[1 See a Lecture on Prolapse of the Ovaries, Medical News and Library, Philada., Nov. 1879; from which the above account of this disorder has been condensed.—H.]

siderable time, of the *knee-breast* position, with rest in bed for some hours after it. Internally, remedies are advised which tend to lessen uterine and ovarian congestion; as bromide of potassium and digitalis; also, such tonics and alteratives as the general condition of the patient may indicate. Locally, an elastic ring pessary may generally be worn with advantage.—H.]

OVARIAN TUMORS.

By John Williams, M.D.

The ovary is composed of two histological structures—an epithelium and a vascular stroma. The first appearance of the organ, according to Waldeyer, is a thickened layer of germ epithelium, investing an outgrowth rich in cells projecting from the interstitial tissue of the Wolffian body. By the increase of these two structures, and their reciprocal growth, the mass of the ovary is formed. In the course of development the epithelium dips into the stroma, and processes of the latter grow into the epithelium. In this manner epithelial tubes and ingrowths of epithelium are formed in the stroma. The tubes are called the tubes of Pflüger: they at first open on the surface. As the stroma grows the tubes become closed, and the ingrowths of epithelium separated from the superficial layer and its processes. In this manner isolated masses of epithelium become inclosed in the meshes of the ovarian stroma. These masses develop into Graafian follicles—the change being completed early in infancy. Foulis does not admit the existence of Pflüger's tubes and their development into Graafian follicles, but believes that the germ corpuscles which are imbedded in the stroma become ova, that the Graafian follicles are the ultimate meshes of the stroma formed by the growth of the "connective tissue around the developing primordial ova," and that the "connective tissue corpuscles in the walls of the follicles in contact with the yelk develop into the corpuscles of the membrana granulosa." Whichever of these views be correct, we should naturally expect that the new growths formed in an organ possessing the structure described would often possess a cystic character; and experience does not disappoint the expectation, for by far the greater number of ovarian tumors are cystic.

Varieties.—Tumors of the ovary may be benign or malignant, solid or cystic. The solid and malignant are, however, rare.

Ovarian Cystic Disease.

Ovarian cystic disease is clinically divided into simple unilocular cysts, multiple cysts, multilocular cysts, and dermoid cysts. Pathologically a similar division holds—the two first being comprehended under dropsy of the Graafian follicle.

Dropsy of the Graafian follicle, hydrops folliculi, is the simplest form of ovarian cyst. It does not usually attain a large size. Such cysts are often not larger than a cherry; sometimes they attain the size of the fœtal head; and occasionally, but rarely, become so large as to fill the abdominal cavity and stretch the abdominal walls. When small they have a structure similar to that of the Graafian follicle; a fibrous coat derived from the stroma of the ovary—an inner coat on which the epithelial lining is placed, corresponding to the tunica propria of the follicle. Their contents are a clear fluid, and the ovum has in some instances been found in such cysts. As the cyst grows its walls become thicker and firmer, tougher, and more opaque. In thickness they vary much in different parts of the same cyst, as well as in different cysts. In some parts the wall may be extremely thin, while in others it may attain a thickness of one inch.

Cysts of this nature have been found in the ovaries of children—even in those of the new-born—as well as in those of adults. In the fœtus and child the condition is evidently due to hypersecretion of the fluid of the follicle, for at this period of life the Graafian vesicle contains little or no liquor folliculi. In the adult it may arise from the same cause. In many cases, however, it appears to be the result of some condition which prevents the rupture of the mature follicle and the escape of the ovum, such as thickening and induration of the coats of the follicle, in consequence of inflammation, and, it has been said, of congestion and hyperæmia.

Such cysts may moreover be developed from a ruptured Graafian follicle, or from

a corpus luteum. Rokitansky says that cysts formed in this manner are "always lined by a stratum thicker than the wall of the follicle itself, which adheres to it either very loosely by delicate areolar tissue, or very intimately by a dense connective tissue. This lining stratum is of a dirty white color, and has a rough inner surface. It may be recognized as the yellow layer of the corpus luteum which has been rendered thinner by expansion, and the roughness of its inner surface is occasioned by some of its remaining folds."

Several Graafian follicles in the same ovary may undergo cystic transformation, and form a *multiple cystic tumor*. The individual cysts of which such a tumor is formed possess a structure similar to that of simple cysts. As they grow and enlarge, one usually takes precedence of the others; they approach to and exercise mutual pressure on one another. In consequence of this pressure atrophy and absorption of the walls of the cysts takes place, and a communication is ultimately established between neighboring cysts. As growth proceeds, the aperture of communication gradually enlarges, its borders retract and become less and less prominent, until finally two cysts completely merge into one, the only evidence remaining of the original condition being a slight ridge on the inner surface of the resultant cyst, or a slight thickening of its walls marking the line of union of the walls of the original cysts. As this process affects the primary cysts in succession they gradually become merged into one common cyst. In the course of this process the tumor may assume a multilocular character, and it often presents hemispherical protuberances on its external surface, and hollows or sacculations with intervening ridges on the internal surface of its walls, representing the original cysts from which it was formed.

Multilocular cysts, compound, composite, proliferous cysts, cystoma, cystoid, or adenoid tumors, have a very different structure. They are rarely single-chambered. In some instances they are formed of one large cyst, with a few small ones within it. In others the tumor forms a semi-solid mass, so divided into smaller cysts by partitions crossing its interior that it presents in section a honeycombed structure. Every transitional form, from the more simple to the most complex, may be met with. These tumors have been called colloid cysts on account of the character of their contents. Waldeyer calls them myxoid rather than colloid, because the contents of the ovarian cystoids are never pure colloid, and in order to express the true relation between the cysts under consideration and dermoid cysts: for he says that the inner surface of dermoid cysts has the character of epidermis, while the inner surface of myxoid cysts has the appearance and character of a glandular and vascular mucous membrane.

All cysts of the ovary are covered by peritoneum. This may be natural in character, or it may have become rough or adherent to neighboring structures in consequence of inflammation. It has occasionally small villous, or globular epithelial growths on its surface. Waldeyer maintains that the ovary is not covered by peritoneum, and that this membrane does not form the superficial covering of ovarian cysts. He believes that the epithelium covering the ovary is not the homologue of that of the peritoneum, but that it is a columnar epithelium of a mucous character, having the same origin as, and precisely similar in character to, the epithelium lining the Fallopian tubes, with the one exception that the latter is furnished with cilia, while the former wants them. It is in this that he finds the cause of the frequent absence of adhesions between ovarian tumors and neighboring organs. "Serous surfaces readily become adherent, and epithelial surfaces may become adherent to one another or to serous surfaces; yet in order to effect this the superficial epithelium must be destroyed. So long as the surface of an ovarian tumor is covered by epithelium it cannot grow to neighboring structures, adhesions can only take place after the loss of the epithelium. When numerous adhesions are present the epithelium is always wanting." Waldeyer states that the villous excrescences on the external surface of ovarian tumors and the vegetations which protrude in some cases through the cyst wall do not form adhesions because they are covered by a well-marked columnar epithelium. Dr. Peaslee states that the part of the cyst wall formed by the ovary is not covered by epithelium, and that it can be distinguished by its greater whiteness and lesser degree of vascularity from the part of the cyst which is covered by peritoneum. Foulis however does not agree with the observations of Waldeyer upon this point. He states that the epithelium of the human ovary at six and twelve years of age consists of small flat hexagonal corpuscles, and regards it as homologous with the peritoneal epithelium.

The walls of the large cysts are separable into two layers, one external and one internal. The wall—especially the external stratum of it—of the principal cyst includes all the secondary or daughter cysts. It varies much in thickness. The external layer consists of tough fibrous tissue with very few cells; the internal layer is softer, more fleshy-looking and vascular, is composed of fine fibres with an abundance of cells. The walls are highly vas-

cular; the veins especially are large, and are seen in great numbers under the peritoneum. The arteries lie deeper and penetrate to the inner surface, where they anastomose freely. They are of large size, and possess thick walls, and in some instances, according to Wilson Fox, retain the twisted or corkscrew-like appearance, which characterizes those of the ovarian stroma.

The epithelial lining of ovarian cysts presents a variety of characters. It lines the whole of the internal surface, and forms usually a single layer of cells. According to Wilson Fox, the shape of the individual cells is usually a flattened polygonal approaching more or less to the circular form. In other cases they have a more flattened form, and are hardly distinguishable from the elongated cells of the connective tissue beneath. In other cases, according to the same authority, the epithelium assumes a stratified character, and forms several layers. In all the cases examined by Waldeyer it formed a single layer of cylindrical cells. Ciliated epithelium has been met with on the inner surface of cystoids by Virchow and others.

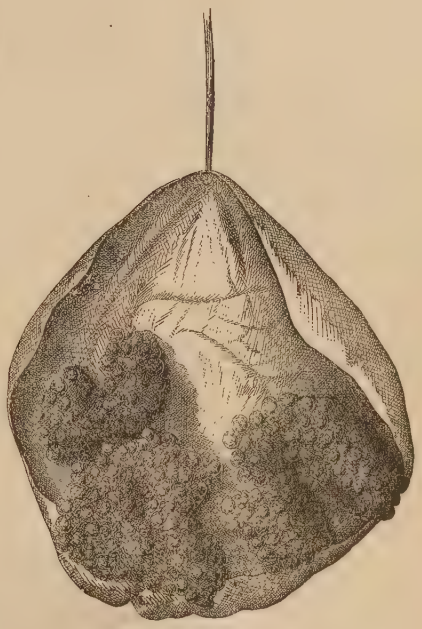
The walls of the smaller secondary cysts are formed of the inner layer only of the chief cyst wall. According to Waldeyer it is a tunica propria like that of the Graafian follicle in its early stage of development.

The mode of development of ovarian cystoids is still a subject of discussion. It was at one time thought that all ovarian cysts arose from cystic transformation of the Graafian follicle, and Dr. Wilson Fox, in an elaborate memoir published in the Transactions of the Medico-Chirurgical Society, has shown how the most complex cystic structures may arise from the Graafian follicle by the development of certain growths from its inner surface.

He describes three such growths—the papillary, cauliflower or dendritic, the villous, and the glandular.

The simplest forms of papillary growths are small club-shaped elevations on the inner wall of the cyst; they are first composed of a hyaline finely striated tissue, with many elongated nuclei. They are covered by epithelium, and contain loops of vessels. These growths increase in size, and give off similar processes from their surface, and thus give rise to large composite masses. They are exceedingly vascular, their vessels being of a large size. They are solid, and now the central parts are fibrous, and the superficial hyaline, there being a gradual transition from the former to the latter. They may form over large portions of the cyst wall, or over small portions only. These growths give rise to formations of cysts in the following manner: As the papillæ increase in size adjacent growths approach one another, and their surfaces come into contact at different parts. At the points of contact they unite, and inclose spaces lined by epithelium similar to that cover-

[Fig. 100.



Papillary Growths in a Cyst. (Emmet.)]

ing the papillæ and lining the principal cyst. These spaces are the commencement of secondary cysts. They may be found at the bases of the papillæ, or between the processes developed from them. They are of various and irregular shapes, but become round as their walls become distended by the accumulation of the secretion from their epithelial lining in their interior. The walls of such secondary cysts may develop papillary growths similar to those by means of which they were formed. These growths may form on their inner or outer surfaces, and may give rise to the formation of cysts in a manner similar to that already described, and these tertiary cysts may give rise to another formation of cysts by a similar process. Such multiplication or breeding may go on indefinitely.

Villi are very frequently found on the inner surface of ovarian cysts. They may be scattered over the surface or arranged in dense clusters. When scattered they do not attain a large size, and are often branched. They are covered by several layers of epithelium, which tends to assume the columnar form. When densely crowded together they give rise to the formation of tubular structures or cysts like the glands of the stomach. The first indication of the formation of

villi is a stratification of the epithelium lining the cyst. Into these stratified masses of cells processes of the inner lining of the cyst containing a loop of vessels grow. In this manner a series of papillæ are formed with hollows or pits lined with epithelium between them, which are converted into tubular glands by a growth of the connective tissue of the stroma between the papillæ and around the hollows. As the stroma grows upwards between the papillæ the tubular glands deepen and become more and more imbedded in the cyst wall. Vessels sprout up into the walls of the glandular tubules, and anastomose with those of the villi, forming arches at various depths of the tissue. These glands rarely multiply by lateral diverticula. A very common mode of increase, however, is by enlargement of the base of the gland, and a development of vascular papillæ from its centre in a fashion similar to the development of the primary villi. These papillæ may form tubular glands, and by a repetition of the process in the same gland its cavity may become subdivided by a series of septa into several tubes, all having a common outlet.

These glands may form cysts in various ways. The orifice of the gland may become closed by pressure on its sides; adhesion may take place between the touching surfaces, and the opening become sealed; or the gland may become dilated into a series of cysts, or follicles, across which septa may grow from the thickened walls and completely separate the several follicles, converting them into cysts; or the stroma of the ovary may grow upwards to such a degree as to include the whole of the papillæ, and inclose the whole of the gland in its substance. This would give an appearance of the development of glandular structures within the walls of the cysts. Indeed, in all cases in which the stroma of the wall has grown upwards between the papillæ, an appearance of the growth of glandular diverticula from the inner surface of the cysts into the substance of its wall is brought about. Dr. Wilson Fox, however, believes the above to be the true explanation of the process.

Dr. Fox describes another method in which multiplication of cysts may take place. The cysts produced in this manner are transparent, and possess very

[Fig. 101.

Papillary Projections after Rupture of a Cyst. (Emmet.)]

thin walls. The process is similar to that by which diverticula or buds are given off from glandular structures. Hollow processes, having a flask-shape appearance, grow from the wall of the cyst. These processes have thin walls; their orifices of communication with the parent cyst are very fine and narrow; but their canals immediately expand, so as to form flask-like sacs. They are lined by polygonal epithelium, continuous with that lining the parent cyst. In this manner a multiplication of secondary cysts may go on indefinitely. Such secondary cysts, as they increase in size, may come in contact with one another, or with the walls of the parent cyst; union may take place at the points of contact, and several

cysts may thus be merged into one, and leave no trace by which their mode of origin can be discovered.

Rindfleisch also believes that most ovarian cysts can be traced back to Graafian follicles, or to the tubes of Pflüger, and that the formation of secondary cysts results from the union of neighboring papillæ developed within the primary cysts. Such union may take place in the course of, or at the extremities of, the papillæ. He maintains, however, that all ovarian cystomata do not arise from Graafian follicles, but that some are independent new formations in the stroma of the ovary. He says that "the connective tissue becomes in parts infiltrated with young round cells, and a colloid softening of the stromal connective tissue takes place:" and believes "that certain swollen transparent points in the stroma, which are not perfectly round and sharply defined, ought to be regarded as rudimentary cysts. In these the colloid matter is more diffusely infiltrated among the fibrous elements of the stroma; nevertheless, as it expands, it will inevitably tend to assume a spheroidal form, and to become marked off from the surrounding tissues as a globular cavity traversed by septa of connective tissue."

Waldeyer rejects both these views—that the Graafian follicle is the origin of cystoma, and that softening of portions of the stroma is the origin of cysts. He traces all cystoids of the ovary to the epithelial structures of the organ, and regards them as epithelial neoplasms. It has been already stated that according to this author, the Graafian follicles are developed from masses of the germ epithelium of the ovary, which have become embedded in the ovarian stroma. It is to these masses of epithelium that Waldeyer traces back the origin of cystomata. The transformation into Graafian follicles of these epithelial masses is completed, however, in the third year of life. Waldeyer accordingly maintains that a large number of ovarian cystoids date back their origin to a very early period of life, before the transition of the epithelial masses into Graafian follicles is completed, and that portions of the epithelial masses embedded in the ovarian stroma, instead of developing into Graafian follicles, undergo cystic transformation.

With regard to the origin of other cystomata, though no new follicular growths can be developed from the superficial ovarian epithelium after birth under normal circumstances, yet Waldeyer maintains that under pathological conditions such development is not only possible, but actually takes place. In proof of this he states that he has found immediately under the surface of the ovaries of aged women, small cysts up to the size of a pea, having clear, watery contents. They are like a cystoid in miniature, and are lined by columnar epithelium, which dips into the cyst wall in the form of tubular glands, corresponding to the glandular processes of a glandular cystoma. He has never found an ovum in such cysts, but he has in some instances found a direct connection between these cysts and the superficial epithelium of the ovary, and he regards them as the result of a pathological embedding of the superficial epithelium in the stroma of the organ.

Waldeyer thinks that the first development of ovarian cystomata does not start from the usual egg-containing Graafian follicle, but from a more embryonal form of the epithelial constituents of the ovary,—round epithelial or tubular structures, comparable to Pflüger's tubes, which originate probably from an embryonic period of the ovary, and were not developed into normal Graafian follicles, but took a pathological action from the first; or which originated from a repeated embedding, or ingrowth, from the surface of the ovarian epithelium.

Cystomata have generally been regarded as proliferous, that is they are formed of a parent or of parent cysts which have bred and formed secondary or daughter cysts, but Förster maintained that all the cysts forming a cystoma are formed side by side according to a primitive type. The view advanced by Hodgkin and Rokitansky, however, that they are proliferous, that secondary cysts form from parent cysts, and tertiary cysts from secondary cysts, etc., has been incontestably proven by the labors of Wilson Fox and others.

Waldeyer differs from Fox, not only with regard to the origin of cystoid, but also with regard to their mode of growth. Fox maintains, as we have seen, that there is here a peculiar mode of cyst formation, arising from the coalescence of the walls of neighboring papillæ at various points of their course.

Waldeyer, on the other hand, denies this mode of cyst formation, and believes that the secondary cysts are formed in a manner similar to the development of cysts in other situations, that is by the formation of diverticula or sacs of the epithelium of the inner surface, which penetrate into the substance of the cyst wall. He figures such secondary cysts in the wall of the parent cyst, and one of his figures shows secondary cysts projecting on the surface of the parent cyst, the secondary cysts being formed apparently by the dilatation of glands, in consequence of the accumulation of their secretions, from the plugging of their orifices by gelatinous contents. There does not appear to be anything in these, however, inconsistent with the view of Wilson Fox.

Cystomata may occur in one or both ovaries, and form tumors of various magnitudes. They are often so large as to fill

the abdominal cavity, and distend the abdominal walls, causing œdema of the parietes and of the lower limbs. Some have a tendency to become unilocular, while others become more complex and multilocular. Peaslee has accordingly named the former oligocystic and the latter polycystic. It is said that the younger the tumor the greater generally is the number of cysts, while old tumors may be formed of one large cyst with a few or no small ones.

Ovarian cysts are attached to the uterus by a pedicle. This may be short or long, stout or slender; sometimes it is tough and firm, in other instances it is fragile and breaks down easily, hardly bearing a ligature. It is composed of the ovarian ligament, the Fallopian tube, and the broad ligament. The extremity of the Fallopian tube is often adherent to the tumor, its fimbriæ being spread upon it. At the point of attachment of the tube, or near to it, are to be found the remains of the ovary, should any portion of the organ be not implicated in the growth. In the pedicle the bloodvessels, which are sometimes very large, and the lymphatics, run into the cyst.

The contents of ovarian cysts are extremely various. They may consist of a thin clear fluid having a specific gravity of 1007 to 1015, or of a firm jelly; while they may present every degree of transition between these two forms. Usually the larger cysts have the more fluid contents, and the smaller the more solid. This is true of the several cysts entering into the formation of the same tumor as well as of cysts from different tumors. The fluid may be pale, clear, and transparent. This is especially the case in unilocular cysts. When such cysts have been tapped their contents become thicker, more viscid, and of a darker color; occasionally they resemble an infusion of coffee, sometimes they are blood-stained. Contents of a green, yellow, dark brown, black, inky, like gruel or custard, and a mixture of fluids or solids like brain matter have been met with.

The amount varies according to the size of the tumor. Forty or fifty pounds of fluid is not uncommon, and 130 or even 160 has been reached. When tapping has been had recourse to the character of the fluid withdrawn is altered. It usually becomes thicker and darker with each successive operation.

Chemically, according to Eichwald, the contents of cystomata may be divided into two classes, the mucous and the albuminous.

The mucous series consists of—

The material of colloid globules,
Mucin,
Colloid material, and
Mucous peptone.

These four substances are distinguished only by their different degree of solubility in various liquids.

The material of colloid globules dissolves in weak alkalies.

Mucin dissolves in solutions of the alkaline earths, and swells in an extraordinary manner in water.

Colloid matter is partially readily soluble in cold, and still more so in hot water.

Mucous peptone dissolves readily and completely in water at any temperature.

In the same degree as these substances require alkalies for their solution will they be precipitated from their solutions by acids; so that the material of colloid globules and mucin are completely, colloid material incompletely, and muco-peptone not at all precipitated by acids. The precipitate is insoluble in excess of acetic acid. On the other hand every member of the group is soluble in mineral acids, but not in the same degree; the material of colloid globules being the least and muco-peptone the most readily dissolved by these solvents.

The substances are never precipitated from their acid solutions by ferro-cyanide of potassium.

They are not usually precipitated by tannin, or by neutral metal salts, but are completely thrown down by basic lead salts.

The albumen series consists also of four substances—

Albumen (and fibrine),
Paralbumen,
Metalbumen,
Albumen peptone (fibrine peptone).

These are distinguished from the mucin series generally by their being precipitated from their solutions by tannin and neutral metal salts. The first three moreover undoubtedly contain sulphur. There is doubt whether this element enters into the formation of albumen peptone.

As regards the solubility of this group, a gradation similar to that found in the mucin series is met with. Like mucin, albumen is insoluble in water, dissolves however in alkalies, and is precipitated from its solution by acids. Albumen peptone, like mucous peptone, is completely soluble in water, alkalies, and acids. Paralbumen and metalbumen correspond to colloid material. Paralbumen appears to be more soluble than albumen, as influences which throw down the latter by the withdrawal of water from animal fluids, precipitate the former less readily and completely. A further distinction lies in the fact that the combinations which paralbumen forms with mineral acids are more readily soluble in water than the corresponding combinations of albumen.

The solids usually found on microscopic examination are granules, globules of fat, granular cells, epithelial cells, crystals of cholesterine, blood corpuscles, and disintegrated blood, pus cells and compound granular cells or inflammatory globules of Gluge. Some of these are present in the contents of every ovarian cyst, but it is rarely that all are found together in one specimen. Of these bodies the most important is the granular cell, and it is almost invariably present.

According to Dr. T. M. Drysdale, "This granular cell, in ovarian fluid, is generally round, but sometimes a little oval in form, is very delicate, transparent, and contains a number of fine granules, but no nucleus. The granules have a clear, well-defined outline. These cells differ greatly in size, but have always the same structure. They may be seen as small as $\frac{1}{2500}$ inch in diameter, and from this to $\frac{1}{200}$ inch. In some instances I have found them much larger, but the size most commonly met with is about that of a pus cell. The addition of acetic acid causes the granules to become more distinct, while the cell becomes more transparent. When ether is added the granules become nearly transparent, but the appearance of the cell is not changed. This granular cell may be distinguished from the pus cell, lymph corpuscle, white blood-cell, and other cells which resemble them, both by the appearance of the cell and by its behavior with acetic acid."

He adds, "This ovarian granular cell I consider as diagnostic of ovarian dropsy, and have seldom failed to find it in this fluid, except in some of the earlier cases, where it probably existed but was overlooked from inexperience in the examination of these fluids."[1]

[Foulis[2] and Knowsley Thornton[3] have shown that, while the granular cells of Drysdale are common only in simple or innocent ovarian tumors, in malignant tumors there are found characteristic groups of "large, pear-shaped, round or oval cells, containing a granular material with one or several large clear nuclei, with nucleoli, and a number of transparent globules or vacuoles." This is Knowsley Thornton's description. Foulis calls them "spouting masses of cells;" and insists on the importance also of their being found in bloody ascitic fluid. Both of these observers consider such groups of proliferating cells to be pathognomonic of "malignant peritonitis" or ovarian cancer.[1]—H.]

Dermoid cysts though occurring most frequently in the ovary, have been met with in other regions, and in the male as well as in the female. Lebert applied to them the term dermoid because they contain skin.

The wall consists of two layers, an internal and an external.

The inner coat is smooth, having prominences in different parts; it consists of true skin. The epithelium consists of several layers of cells, the innermost of which are flattened and non-nucleated, while the deeper are round or polygonal in shape. Under the epithelium is a layer of tissue similar to the cutis, frequently having papillæ on its surface, but not always. When papillæ are present they are arranged irregularly, and do not run in rows like those seen on the skin of the palm or fingers.

Beneath this cuticular layer is a stratum of fat, analogous to the panniculus adiposus. This is inclosed in an external fibrous envelope.

The layer of the cutaneous wall contains hair follicles with which sebaceous glands are connected. Other sebaceous glands open on the surface. Heschl and others state that they have found sweat glands also in this wall.

The contents of dermoid cysts consist of some fluid, and a greasy yellowish substance composed of epithelial cells and sebaceous secretion. Sometimes cholesterine is present in great abundance, and traces of oxalic acid are said to have been found.

Hair, teeth, and sometimes bone, brain substance, nerves, and muscular fibre form part of the contents of these extraordinary structures.

The hair formed in them is usually fine like wool, of a blonde or reddish color, but sometimes dark. It varies in length from a few inches to two feet. It is generally rolled up into balls and separate elongated masses, which are sometimes completely isolated from the inner surface of the cyst by being lodged in a capsule. In some instances long hairs have been found attached to the inner surface.

Perfect teeth having the characters of incisors, canines, molars, have been met with in dermoid cysts, and in some instances they have been found to follow the order of succession occurring naturally; that is a deciduous tooth has been found to undergo atrophy and absorption, in consequence of the pressure upon its fang caused by a permanent tooth growing under it. Such perfect structures are

[1 See, *per contra*, a discussion in the Pathological Society of Philadelphia, reported in Phila. Med. Times, April 12, 1873; also Med. News and Library, May, 1873, p. 75.—H.]

[2 Brit. Med. Journal, July 20, 1878.]

[3 Ibid., Sept. 7, 1878.]

[1 Emmet, Principles and Practice of Gynæcology, Philada. 1879, p. 783.]

however of rare occurrence, and usually the teeth found in these cysts are rudimentary or imperfect. Many are badly formed, either from excess or deficiency of growth. They arise from bone or from the stroma of the cyst wall. The number present varies. As many as three hundred have been found in a single cyst. Commonly there are few—1 to 10 present.

The osseous structures occur in the form of laminæ, or masses of irregular shape, firmly imbedded in the cutis. They are usually small, but pieces as large as the palm of the hand have been met with. They have the true structure of bone, but the laminæ are larger and fewer than those of bone, and the canaliculi are less numerous. Instances have also been recorded in which pieces of bone have been articulated by loose capsular ligaments. Vanderwich found a small, hollow bone, with an external covering like periosteum, and lined by a membrane analogous to the dura mater.

Striped muscular fibres have been discovered in dermoid cysts by Virchow, and brain substance and nerve cords have several times been detected.

Dermoid cysts have been regarded as the result of the imperfect development of an ovum, taking place either spontaneously or in consequence of impregnation. Their origin has also been explained by the early inclusion of an ovum which is imperfectly developed within another ovum which attains perfection. On the latter supposition two ova become impregnated at about the same time, and in the course of development one becomes inclosed in the other; the latter undergoes full development, while the former develops skin, hair, and bones only.

The evidence, however, against all theories which refer the origin of dermoid cysts to the development of an ovum under any circumstances is overwhelming.

They have been seen in organs other than the organs of generation, as the lungs, thyroid glands, kidneys, &c. They are not infrequently observed before puberty, when the influence of the male was not possible: they have been met with before birth.

With regard to the theory which refers their origin to the inclusion of one ovum within another, the above objections do not apply, and yet this theory is no less unsatisfactory than those which refer their origin to the development of a single ovum. That inclusion of a germ within a germ does occasionally take place is not improbable, and this fact would render the theory at first plausible.

About three-fifths of dermoid cysts are found in the female, and two-fifths in the male: and three-fifths of all dermoid cysts are found in the ovary, while the majority of those met with in the male are in the testicle: so that there is some cause which determines the formation of these growths in the generative organs of the male and the female, and this renders highly improbable the theory of inclusion.

The view of the origin of these cysts now generally received is that they are congenital and due to a displacement of the external layer of the blastoderm. From this layer the epidermis and other structures are developed, and it is supposed that a portion of it becomes included in the part of the middle layer from which the ovary is formed, and forms the rudiments of cysts of a dermoid character.

Tubo-ovarian is a term applied to those cysts whose walls are in part formed by the ovary and in part by the Fallopian tube. The portion of the cyst formed by the ovary is lined by a smooth or uneven yellowish membrane, which is not continued into the part formed by the tube. A part only or the whole of the Fallopian tube may contribute to the formation of such cysts. The junction of the tube and ovary is marked occasionally by a slight constriction. The greater part of the cyst is formed by the ovary. Such cysts occasionally pour their contents into the uterus along the Fallopian tubes and become collapsed. Mr. Spencer Wells has described such cases, and has in some instances found the collapsed cysts on examination after death.

Tubo-ovarian cysts are said to be formed in the following manner: At the time of rupture of a Graafian follicle the point of rupture is grasped by the fimbriæ of the Fallopian tube. After the rupture has taken place the fimbriæ do not retract, but remain adherent to the ovary. The corpus luteum resulting from the ruptured follicle undergoes cystic degeneration, as is shown by the yellowish lining of the ovarian portion of the cyst, the communication between the follicle and the canal of the tube is maintained, and in this manner the cyst is formed jointly by the two structures.

Cysts may moreover be developed in the immediate neighborhood of the ovaries, in the Fallopian tubes, and the broad ligament.

Cysts of the Fallopian tubes do not usually attain a great size, but Dr. Peaslee relates a case in which a cyst having this origin had attained a capacity of eighteen pounds. They are the result of inflammation of the tube causing closure of its orifices or obliterating it in some parts of its course, and of an accumulation of secretion or of an effusion of blood into its canal. The outer being the most distensible part of the tube the principal enlargement occurs at that part, and the rest remains less distended, maintains a

tortuous course, and is sometimes sacculated in consequence of constriction by inflammatory products. Both tubes are usually affected; the wall is thin, the lining membrane smooth or rough, and exhibiting papillary growths.

The contents may be watery, mucous, sanguineous, or purulent.

Cysts of the broad ligaments are of two kinds, those arising from the terminal vesicles of the Fallopian tubes, and those arising from the tubules of the par-ovarium. The cysts arising from the terminal vesicles of the Fallopian tube or remains of the Wolffian body are usually small, about the size of a pea or a nut; occasionally they attain the size of an egg. They are covered by peritoneum, have very thin walls, clear watery contents, and hang by a slender pedicle. They often burst, and their contents escape into the cavity of the peritoneum, but give rise to no trouble. They have been discovered not so often during life as during post-mortem examination.

Cysts derived from the tubules of the par-ovarian occasionally grow to a large size. They are covered by peritoneum; their wall is composed of fibrous tissue, but it is comparatively thin, and is lined by columnar epithelium. Their contents consist of a thin, clear, serous fluid. They rarely refill after tapping, or after accidental rupture of their walls.

Causes.—Very little is known concerning the causes of ovarian cysts. This is perhaps due in part to the fact that it is not possible to fix the exact date of the commencement of the disease. The first evidence of its presence is an abdominal tumor, but at that time the disease has lasted some considerable time. There may be nothing to note in the previous history, or there may have been pain in the region of the diseased ovary, and general failure of the health; such data are not enough to fix the time of the commencement of the disease.

No age is absolutely free from it. As far as observation at the bedside goes, it is very rare before puberty; it has, however, been observed in children of all ages. On the other hand, observation after death shows that the disease is by no means uncommon at birth. Small cysts are frequently met with in the tissues of the fœtus; and some have maintained that the majority of all cystomata as well as dermoid cysts have a congenital origin. If they be of congenital origin, it is after puberty they usually begin to grow—during the period of functional activity of the organs of generation. Nearly a half of the cases occur between thirty and forty years of age. They are met with after the menopause, and occasionally at a late age.

The exercise of the sexual functions does not predispose to ovarian cystic disease. West found that of 327 cases 94 were single, 31 were widows, and 202 were married or had had children; that is "considerably more than a third of all cases of ovarian disease began at a time when the sexual functions were not in active exercise; and more than a fourth occurred in women in whom these functions had never been exercised at all."

Sanzoni regards chlorosis and disorders of the uterine functions as predisposing causes of ovarian cystic disease; while others have not found such a relation between the two affections. It is however certain that women the subjects of ovarian cysts are less prolific than others; while many of them are absolutely sterile. The relation between the two conditions is uncertain; it may be that sterility and a less degree of fecundity favor the development of ovarian cysts; while, on the other hand, and this is the more probable, it may be that in most cases of this disease there is from the first the abnormal condition of the ovaries which accounts for the absolute or comparative sterility present, and which tends to develop cysts. The tendency of modern pathological research is in favor of the latter view.

Course.—Ovarian cystomata tend to grow until they fill the abdominal cavity, distend its walls, encroach upon the thoracic cavity, press up the abdominal and thoracic viscera, and finally cause death by interfering with the nutrition of the body and the functions of the vital organs. They are, however, subject to a variety of changes which may affect their course in a marked manner. These we shall briefly notice.

Cases of spontaneous absorption of ovarian cysts and cure have been recorded. There is no doubt that a considerable quantity of fluid supposed to have been inclosed in a cyst of the ovary has in some instances disappeared, and this has been accompanied by a profuse discharge of a watery fluid from the bladder or bowel. It is generally believed that so long as the fluid is confined in the cyst it is incapable of absorption, and the process which takes place in the alleged cases of absorption is somewhat uncertain. It may be, as Barnes suggests, that the fluid had first escaped into the peritoneum, and became then absorbed, or into one of the neighboring organs in consequence of a small perforation.

In some instances the growth of the tumor has ceased suddenly and finally: in other cases the quiescent state has been temporary only. Ritchie has recorded a case in which increase and diminution in the size of an ovarian tumor alternated until it terminated fatally. Cure has re-

sulted from rupture of the cyst, the discharge of its contents into the peritoneal cavity, and their subsequent absorption. In most cases where the contents escape, whether by tapping or injury, they reaccumulate. Rupture may result from violence, blows, or falls, or spontaneously without assignable cause.

The escape of the contents of an ovarian cyst into the peritoneal cavity is rarely free from danger; it frequently proves fatal. When the fluid is of a bland and non-irritating character it becomes readily and rapidly absorbed when discharged into the cavity, and is carried off by the skin or kidneys. Should it be thick and irritating, as the contents of polycysts frequently are, severe and fatal inflammation is almost sure to follow.

Cysts sometimes become the seat of inflammation, either spontaneously or in consequence of accident or injury. This may lead to the formation of pus or of a foul and offensive fluid in the cavity of the cyst, or to general peritonitis. The offensive fluid may become absorbed and give rise to pyæmia or septicæmia and death: or the cyst may become perforated, the foul matter be discharged into the peritoneal cavity, and set up rapidly fatal peritonitis.

In some instances the pedicle has become twisted. In such cases the blood-vessels are constricted; there is obstruction to the return of the blood from the tumor. This may lead to gangrene or hemorrhage into the cyst, causing sudden distension of the abdomen, collapse, and death. Should the twisting be brought about in a gradual manner, the pedicle may undergo gradual atrophy, and the tumor be ultimately separated from its attachment and lie free in the cavity of the abdomen.

The contents of an ovarian cyst may be discharged into neighboring organs. Adhesions form between the cysts and the organ, and ulcerative perforation or rupture of the cyst wall takes place at the place of union. In this way the cyst contents may be discharged into the Fallopian tubes, the bladder, bowel, vagina, or into the lung and pleura. When an opening forms from the intestine into the cyst, the contents of the bowel may enter its cavity and give rise to fecal abscess and death.

In some instances great hemorrhage has taken place within an ovarian cyst, without assignable cause.

The pedicle may give rise spontaneously, and the tumor float in the abdominal cavity, or become attached to some other part and continue to grow.

Death occasionally takes place from asphyxia, arising from pressure on the heart and lungs; in other rare cases sudden and fatal collapse has occurred.

Symptoms.—The symptoms of ovarian cystic tumors vary much. Different persons manifest tolerance of such growths in very different degrees. In some cases no symptoms are apparent until the tumor has attained a size sufficient to cause a distinct swelling above the pubes. In other cases, troubles of a more or less severe character are present from an early period. Pain in the back and a sense of weight in the pelvis are commonly complained of during the early stages—while the tumor is small and lodged in the pelvis. Occasionally severe pain on one side, in the ovarian region, is present before any signs of tumor are manifest. Menstruation may be performed regularly and normally, or it may be accompanied by pain, or amenorrhœa or menorrhagia may be present. The presence of the tumor in the pelvis causes usually a certain amount of trouble in the performance of the functions of the bladder and of the rectum. Irritation of the bladder or frequent desire to micturate is often present; occasionally there is incontinence and now and then retention of urine from pressure of the tumor on the neck of the bladder or the canal of the urethra. Irritation of the rectum, constipation, and hæmorrhoids are frequent associates of ovarian growths. Sometimes pains are felt in the lower limbs, owing to pressure on the nerves as they pass through the pelvis. Occasionally symptoms which are usually referred to pregnancy appear during the early stages of ovarian tumor, such as morning sickness, swelling of the breasts, enlargement and discoloration of the nipples and areola, and these may run a course precisely similar to that which they run usually during gestation. I have seen one case where the appearances of the breast were such as are commonly said to be diagnostic of pregnancy: the nipple was prominent, the areola darkened, enlarged, and shining, the follicles swollen, and the so-called secondary areola perfect. A milky fluid may also appear in the breasts.

In some cases the general health suffers from the first or from an early period. The digestion may be impaired and the appetite lost, and a feeling of sickness be constantly present; there may be a general sense of illness or even decided suffering. When the tumor has attained so great a size that it cannot be contained in the pelvis, and that it rises into the abdomen, other symptoms make their appearance. Sometimes the growth remains imprisoned in the true pelvis on account of adhesion, or for some other reason, and then the rectal and vesical symptoms become aggravated and pain becomes severe. In such cases the bladder suffers more than the rectum by reason of the protection given to the rectum by its po-

sition in the pelvis. When the growth ascends above the pubes it forms a distinct tumor on one side of the middle line which can usually be distinctly felt on palpation. It often causes some pain, though itself is not tender unless it or its peritoneal covering be the seat of inflammation. As it grows it becomes less lateral in position, and when it has reached the umbilicus it usually distends the abdomen in an almost uniform manner. The symptoms at this time are chiefly and usually due to pressure. There is a sense of fulness, weight and pain in the back. There may be œdema of one leg and pain, owing to pressure on the veins and nerves. At a later period both legs suffer. The abdomen becomes larger, the superficial veins in the abdominal walls become enlarged, owing to obstruction to return of blood along the common iliac veins; lineæ albicantes appear by reason of the stretching of the abdominal walls; the intestines and stomach become pressed upon and their functions interfered with; constipation, disorders of digestion and vomiting set in; the general health begins to suffer, and in consequence of this amenorrhœa follows. Later still the thoracic organs become the subjects of pressure: the diaphragm and heart are pushed up, the lower ribs spread out, the bases of the lungs pressed upon, so that palpitation, dyspnœa, and imperfect aëration of the blood result. The circulation in the kidneys becomes interfered with, and albumen appears in the urine. Emaciation sets in and this is of a peculiar character, as it chiefly affects the face, neck, and chest, and upper limbs. It gives rise to the so-called facies uterina or ovariana. Mr. Spencer Wells says "the emaciation, the prominent or almost uncovered muscles and bones, the expression of anxiety and suffering, the furrowed forehead, the sunken eyes, the open, sharply-defined nostrils, the long compressed lips, the depressed angles of the mouth, and the deep wrinkles curving round these angles, form together a face which is strikingly characteristic."

The further progress of the disease leads to aggravation of the above symptoms, and death in one of the various ways already mentioned.

Diagnosis.[1]—The diagnosis of ovarian tumors is often very easy, sometimes difficult, occasionally not possible. The abdomen has been opened in several instances, with a view to the removal of an ovarian cyst when not only no ovarian but no other tumor was present. Before entering upon a discussion of the symptoms by which ovarian growths can be distinguished from other abdominal or pelvic tumors, it is necessary therefore to exclude those conditions which may give rise to enlargement of the abdomen, and which may either simulate new growths, or may lead the patient to suppose herself the subject of such growths. These are tympanites, obesity, œdema of the abdominal walls, phantom tumor, and spurious pregnancy.

Great and persistent tympanites occurs in the subjects of chronic dyspepsia. There is often great distress, with uncontrollable belching. The abdomen is tense, uniformly enlarged, and everywhere tympanitic on percussion. The last symptom distinguishes it from solid or cystic ovarian tumor.

Towards the menopause, and in some instances at other ages, women rapidly deposit fat in the abdominal walls and mesentery or omentum. In these cases the layers of subcutaneous fat can be grasped by the hand and lifted, and the umbilicus is hollow and depressed. If there be great deposit in the omentum an indistinct tumor may be felt. On percussion, however, the note is not absolutely dull, though it may not be resonant; the hand may be made by firm and prolonged pressure to sink to the spine and the sensation derived from the mass is doughy and not firm and resistant.

Phantom tumor is seen in hysterical women: it is formed often involuntarily, but in many cases at will. It appears to be due to the contraction of the recti muscles. By careful palpation when the attention of the patient is engaged in conversation or otherwise, or during deep inspiration, the hand may be pressed down to the spine and the absence of a real tumor ascertained. If any doubt remain, an anæsthetic should be administered, when the tumor, if of this nature, will entirely disappear.

So-called spurious pregnancy may occur at almost any age, but most usually it occurs about the menopause; that is, women may, for some reason or no reason, imagine themselves pregnant when they are not, and suffer from many of the symptoms which are present during pregnancy, such as morning vomiting, arrest of menstruation, and so-called quickening. In these cases there is no enlargement of the belly unless due to obesity or tympanites. No tumor can be discovered on examination and the uterus is of normal size.

Œdema of the abdominal walls is readily detected by putting on pressure; but this is a condition which not infrequently accompanies large ovarian tumors, and though it has been mistaken for ovarian growths, yet ordinary care will distinguish between the two conditions.

[1] See a Treatise on General and Differential Diagnosis of Ovarian Tumors, by W. L. Atlee, M.D., Philada., 1873.—H.]

When the above conditions have been excluded, and it has been ascertained that the patient is the subject of an abdominal tumor, it remains still to decide whether it has an ovarian or other origin. There are many conditions which are liable to be mistaken for ovarian growths, and none of them are of greater importance in practice than enlargements of the uterus.

Pregnancy is the most common form of uterine enlargement. In many cases it is readily distinguished from ovarian cyst, yet instances have occurred in which the pregnant uterus has been mistaken for ovarian tumor; and in some cases the diagnosis presents great difficulty. The history is of some service in all cases in which it can be obtained; in some cases, however, the physician is misled by the patient, either accidentally or intentionally, and he has to fall back upon and trust to the results of physical examination alone. Setting aside then the history of menstruation and sexual intercourse, the breasts should be examined. Should they be enlarged, the nipple prominent, with darkened areola and enlarged glands, pregnancy may be suspected, for though these signs may occur with ovarian tumor, they occur with it exceptionally only. During the first two months of pregnancy the uterus remains in the cavity of the pelvis, and bimanual examination cannot fail in ordinary circumstances of recognizing the enlargement of the body of the organ. In the third month the uterus rises and can be felt in the pelvic brim. It does not give a sense of fluctuation until the fifth month. Before that period it feels like a softish, solid mass. After the fifth month fluctuation is present until the full term. This may vary much in degree. When the liquor amnii is abundant, fluctuation may be very distinct, when scanty, difficult to recognize. In both conditions, however, a solid body, the fœtus, may be felt floating in the fluid when the latter is displaced by pressure. During the latter months of pregnancy it is possible in many cases to trace the outlines of the fœtus, and it can be pushed from side to side and made to alter its position. An ovarian tumor complicated with ascites or occurring in a subject having thick abdominal walls, may be mistaken for a fœtus; but when the spontaneous movements of the fœtus are distinctly felt, they are conclusive of pregnancy. Care should be taken that the movements of the abdominal muscles and of the intestines be not mistaken for those of the fœtus, which in some cases they greatly resemble.

In the fifth month the sounds of the fœtal heart become audible: these are diagnostic of pregnancy. A sound similar to the placental murmur is often heard in fibroid tumors of the uterus, and occasionally, though rarely, in ovarian growths, so that this sign is of no great value in diagnosis. The changes in the cervix of the uterus which are found in pregnancy do not occur in ovarian tumors. Hence Wells says that the changes in color of the mucous membrane of the vagina seen during pregnancy are not seen in ovarian cystoma. Peaslee, however, states that this sign is of no value, and attaches greater value to the umbilical areola. The duration of a case often settles the diagnosis, especially when in conjunction with it the size of the tumor is taken into consideration. In extra uterine pregnancy, which is rare, there is during the early period of the disease, the history of pregnancy, and vaginal examination discloses a soft uterus and cervix. Other signs of pregnancy soon make their appearance, should the case go on; on the other hand, should the cyst rupture, the condition present becomes known or suspected. In molar pregnancy there are usually some signs directing attention to the uterus rather than to the ovary, such as hemorrhages, and watery discharges; and in some cases portions of the contents of the uterus escape by the vagina. The diagnosis of ovarian cyst complicated with pregnancy is very difficult because "the enlarged uterus remains in front of the cyst, and no change of posture brings the latter into a situation where it can be reached and fluctuation be detected in it." When during pregnancy the uterus is situated high up so that the cervix is beyond the reach of the finger, and when the abdomen presents an uneven surface, the complications in question may be suspected. In many of the cases in which the condition has been met with, the presence of an ovarian tumor had been recognized before impregnation occurred, while in others the complication was not suspected until it was discovered during the performance of ovariotomy.

There are other enlargements of the uterus which may be mistaken for ovarian tumor. Of these, fibroid and fibro-cystic tumors present the greatest difficulty in diagnosis. In the very great majority of cases the diagnosis is readily made, while in others it is impossible. The following points of difference I abstract from Mr. Spencer Wells's work on Diseases of the Ovaries.

The enlargement of the abdomen is more often general in ovarian and partial and confined to the lower part of the belly in uterine tumor. The umbilical depression is diminished, or the umbilicus may become prominent, in large ovarian cysts. This is rarely seen in uterine tumors unless ascites be also present. The superficial veins of the abdomen are oftener found enlarged with uterine, though not

uncommon with large ovarian tumors. Peaslee, however, states that the abdominal veins are not enlarged in uterine tumors. Both kinds of tumor move with respiration, but uterine tumors appear fixed at their lowest part in the hypogastrium.

When the recti muscles are called into action they "bulge forward in front of a tense non-adherent ovarian tumor or a flaccid adherent cyst. This is seldom well marked in uterine tumors, a solid mass fixed centrally below the umbilicus interfering with the free action of the recti. The girth of the abdomen is increased more on one side than on the other ovarian, more often symmetrically in uterine tumors. The increase of the distance between the pubes and umbilicus is proportionately greater in uterine than ovarian growths. If the tumor be cystic it is presumably ovarian, if solid presumably uterine. Fibro-cystic tumors of the uterus and solid tumors of the ovary are occasionally, though rarely, met with. Uterine tumors are less movable than ovarian, unless the former be pedunculated; the ovarian tumor may be pushed up or raised from the pubes so as to permit the hand to be pressed down between it and the bone; but a uterine tumor cannot be raised at all, and the hand cannot be pressed between it and the pubes as pointed out by McClintock. Both ovarian and uterine tumors give dull notes on percussion, and a murmur may often be audible over uterine tumors, but very rarely over ovarian growths.

By vaginal examination the size and character of the uterus and its relation to the tumor may be determined. If the cervix is normal and the uterus is not enlarged, the tumor is probably not uterine. On the other hand if the uterus be heavy, the cervix and body hard and thickened, the canal distorted and elongated, a condition which may be detected by the uterine sound, then it is almost certain that the tumor has a uterine origin. It should, however, be borne in mind that ovarian tumors may displace the uterus backwards, upwards, downwards, forwards, or laterally, may distort its shape and elongate its cavity; and on the other hand that subperitoneal pedunculated tumors of uterine origin may grow without giving rise to any change in the position and characters of the uterus, and may permit the womb to be moved quite independently of them.

Examination by the rectum is often useful. If the whole hand be introduced into the bowel the size of the uterus, its position, and its relation to the new growth may be accurately determined.

Ovarian tumor and uterine tumor are sometimes present in the same subject. By keeping in mind the possibility of the occurrence of such a complication a diagnosis may be arrived at from a consideration of the symptoms just stated.

From other enlargements of the uterus —hæmatometra, hydrometra, and physometra—ovarian tumors may be readily distinguished.

Hæmatometra forms a median fluctuating tumor which increases gradually and is associated with amenorrhœa and severe pains at the monthly epochs. If the cause of it be congenital, the patient has never menstruated; if acquired, it has been the result of accidents during labor. Local examination will discover closure of the genital canal. Hydrometra occurs in aged women after the menopause, and is due to an accumulation of secretions in the uterine cavity in consequence of closure of the canal of the cervix. Both hydrometra and hæmatometra are rare conditions.

Physometra or accumulation of gas in the uterus is very rare. It occurs in hysterical women, and is accompanied often by escape of gas by the vagina. Percussion would give a tympanitic note, and thus distinguish it from ovarian cyst.

In the majority of cases, and where the abdominal enlargement is not excessive, there is no difficulty in distinguishing between ascites and ovarian cyst. When the abdominal distension is very great, however, much difficulty may be experienced. In ascites there is a history of previous illness, of disease of heart, lung, liver, or kidneys, or of peritonitis. There is œdema of the legs in many cases at an early period, a puffiness, and a pallid appearance of the face. The swelling increases more rapidly than in ovarian disease.

When the patient is lying on the back the shape of the abdomen is different: it is uniformly enlarged, flattened in front, and bulging in the flanks. Uniform enlargement of abdomen is present only in the last stages of ovarian cyst, and the front of the abdomen is always prominent. In ascites, when the patient sits up, the lower part of the abdomen bulges. When lying on the back, there is dulness on percussion in the flanks and depending parts of the belly, but not in front and the most elevated parts. The space over which dulness is found depends upon the amount of fluid present and the amount of air in the intestines. Fluctuation is felt in the dull parts. The seat and area of dulness and fluctuation are altered by position. The fluid gravitates into the most depending parts, and it is there that these signs are met with; so that when the patient is lying on the side, the lower flank is dull and the upper resonant; when she is in sitting posture, the lower part of the abdomen is dull and fluctuating and the upper resonant. In ova-

rian dropsy the most prominent part of the tumor is dull and fluctuating, and the area of dulness and fluctuation is not altered by change of position, and the flanks are resonant.

When the accumulation of fluid in the peritoneum is very great, however, the abdomen may be everywhere dull and fluctuating. In such a case the anterior wall of the belly is carried beyond the reach of the intestines. The intestines are tethered by the mesentery, and in the circumstances referred to the mesentery is too short to permit the intestines to reach the surface of the fluid; or the intestines may be bound down to the posterior wall of the abdomen by adhesions or a thickened mesentery, and similar symptoms result. On the other hand, the area of dulness and resonance in a case of ovarian dropsy may simulate that usually met with in ascites. The cyst may contain air either as a result of tapping or of a communication with the intestine. In these circumstances the most prominent part of the abdomen (the patient lying on her back) would be resonant; and the resonance would be altered by change of the position of the patient much as it is in ascites. In such cases the diagnosis may be impossible, though in some cases examination of the fluid drawn by tapping may supply valuable data for arriving at a correct conclusion.

In estimating the data derived from the latter source, the totality of the characters should be taken into account, and no absolute reliance should be placed upon the presence or absence of fibrin or paralbumen; for fibrin may occur in the fluids of ovarian cysts as well as in ascitic fluid, and paralbumen has been discovered in the fluid of a renal cyst. If on microscopic examination columnar epithelium be found, the fluid is ovarian. Drysdale and others believe that the so-called ovarian cell is diagnostic.[1]

A small quantity of fluid in the peritoneum is often present with ovarian cysts. In some cases, however, there is considerable ascites, and this may greatly enhance the difficulty of diagnosis. When the ovarian tumor is small, it may under these circumstances escape detection; when large, a peculiar condition is found which may give rise to a suspicion of cancer. The diagnosis should be made from the history and after having had recourse to tapping.

Fatty or fibroid tumors of the mesentery or peritoneum occasionally attain a large size. They may simulate ovarian disease so nearly that the diagnosis may become impossible. They have been tapped under the impression that they were cystic.

Renal tumors, both cystic and solid, have been mistaken for ovarian disease, and their true nature discovered only when the abdomen has been opened with a view to ovariotomy. Renal tumors begin in the lumbar region, and grow downwards and forwards, and not upwards from the pelvis. They carry the intestines in front of them, whereas ovarian tumors as a rule push the intestines backwards; when, however, the intestines have become adherent to a tumor of the ovary, they may lie in front of the growth. When the tumor is of the left kidney the large intestine crosses it obliquely from above downwards: when of the right, it runs along the inner border of the growth. When the intestine does not contain air, it may be inflated per rectum so as to give a tympanitic note on percussion, or it may be recognized by rolling it under the finger to excite contractions of its walls. Simm recommends the introduction of elastic tubes into the intestine, to determine its relation to the tumor. In cases of renal tumors there is often a history of urinary troubles—there may be blood, pus, or albumen present in the urine.

Examination by the vagina, or with the hand introduced into the rectum, will discover whether or not the growth is connected with the organs of generation.

A movable or floating kidney occasionally becomes considerably enlarged, and may be mistaken for an ovarian tumor; the peculiar shape of the organ is, however, preserved; the region usually occupied by the kidney is empty; the mass can be pushed up into the normal position of the kidney; and there is no connection between it and the pelvic organs.

Tumors of the liver grow from above downwards, and when they become so large as to reach the pelvis their independence of the pelvic organs can be ascertained by the hand in the rectum.

An enlarged spleen is situated on the left side, and grows downwards and towards the middle line. The elongated tumor formed by it is smooth and firm, and its right border, which runs obliquely downwards, presents the notch characteristic of the organ.

The diagnosis between ovarian cyst and pelvic hæmatocele and abscess can present difficulties only in the case of a small ovarian cyst complicated with inflammation. In such cases the history and the absolute immobility of tumors arising from exudation, sanguineous or inflammatory, will serve for distinction.

In some cases of large abdominal tumors the means enumerated will fail to effect

[1 Dr. Drysdale's assertion is, that the cells found in the fluid of ovarian tumors are absent from the fluid of ascites. It is admitted that similar cells are found in other cystic tumors elsewhere.—H.]

the diagnosis, and in such cases recourse must be had to operative means, as the withdrawal of some of the fluid contents by tapping, incision of the walls of the abdomen, with a view of exploring the cavity and the nature or relations of the tumor. Even these means, however, in some very rare cases will fail to establish the diagnosis. In such cases, and indeed in all cases, the question to be decided by exploratory incision is the possibility of removal of the tumor rather than its exact origin.

Prognosis.—Ovarian cysts rarely, if ever, get well spontaneously. Many never attain a large size, and are discovered on examination after death only. When they have arisen from the pelvis they usually continue to grow, and ultimately prove fatal in one of the ways already mentioned. In some rare instances, however, they have ceased to grow, and have caused but little inconvenience.

Treatment.—The medical treatment of ovarian growths consists in attention to the general health. No medicine, as far as is at present known, has any effect upon their course. The only means that provide relief or cure are surgical—paracentesis or ovariotomy. It is beyond our province to describe these operations, and we must be satisfied with stating that ovarian cysts have been in great part deprived of their terrible character by Spencer Wells and Thomas Keith, who by their labors have rendered ovariotomy one of the most successful of capital operations. [It would be ungracious not to add here the names of McDowell, Atlee, and Peaslee to this brief list of early and representative ovariotomists.[1]

Since the frequent success attending the removal of ovarian tumors, the operation of double ovariotomy, or *spaying*, has been introduced for the treatment of obstinate functional troubles of the ovaries, uterus, and (through sympathy) cerebro-nervous system. This measure is credited to Dr. Battey,[2] of Georgia. In several instances of its performance, advantage has accrued in the relief of ovarialgia, hysteria, epileptoid attacks, &c., connected with what has been called "pernicious menstruation;" and with no observed disadvantage beyond the incapacitation for reproduction. Even the aptitude for conjugal intercourse has not been destroyed. Hegar, Wells, Peaslee, and Goodell all testify, from actual experience in practice, that the removal of the ovaries some time after puberty does not unsex woman, in regard to any of her feminine attributes of appearance, voice, demeanor, or character.—H.]

Fibroid Tumors of the Ovary.

Fibroid tumor of the ovary is an extremely rare disease. A large uterine fibroid which in its growth has involved the ovary may readily be mistaken for an ovarian tumor, and some cases which have been reported as fibroid tumors of the ovary have in reality been tumors of the uterus. Fibroid tumors consist chiefly of fibrous tissue, and appear to be due to hypertrophy of the stroma of the ovary. Muscular fibre-cells have also been discovered in them, but in small quantities only.

Some of these growths, however, are not due to simple hypertrophy of the ovary, but are distinct nodules growing in the substance of the organ. Several such nodules may be agglomerated together and form one tumor. They vary in density, some having a hard uniformly dense structure, others containing smaller or larger loculi or cysts, while a third class possesses a loose vascular texture, and present a cancerous appearance. These tumors do not usually attain a large size; they are rarely larger than a child's head. A case has been reported by Simpson, however, in which a fibroid tumor of the ovary weighed fifty-six pounds.

Like fibroid tumors of the uterus they occasionally undergo a process of calcification. They are, however, subject to far more serious changes, for instances are known in which they have become gangrenous, or have broken down and suppurated, and formed fistulous channels communicating with the vagina or elsewhere. In some cases the pedicle has been found twisted and the tumor in a congested, softened, or livid state, a condition which if left unrelieved would certainly lead to gangrene of the growth.

Pregnancy is a complication associated with gravest danger, for during labor the

[1 Ovariotomy was proposed by Schorkoff, 1685; Schlenker, 1722; Willius, 1731; also, at different times by Peyer, Delaporte, Morvand (1798), the Hunters, and Bell. The first actual performance of the operation was that of Dr. Ephraim McDowell, of Kentucky, in 1809. See T. S. Wells's Diseases of the Ovaries; Amer. Edition, 1873.]

[2 Atlanta Medical Journal, 1872. Trenholme, of Montreal, removed both ovaries as a measure of treatment for uterine fibroid tumor, in 1876. Since then, the same operation has been successfully performed by Hegar, of Freiburg, Nussbaum, of Munich, and Goodell, of Philadelphia (Amer. Journal of Med. Sciences, July, 1878). Sims (Brit. Med. Journal, Dec. 1877) gives account of 28 operations, by eight different practitioners, with 5 deaths. See, for a discussion of this subject, Emmet, Principles and Practice of Gynæcology: Philada. 1879.]

tumor may be so bruised as to suppurate or become gangrenous.

The symptoms present nothing characteristic. They are such as result from the development of any innocent tumor in the pelvis.

The diagnosis is not always if ever possible with certainty, because we can never be sure that we have not to deal with a pedunculated fibroid tumor of the uterus. There are no sure means of distinguishing between the two.

If the growth is believed to be ovarian, it may be distinguished from cancer by its slow increase and its smooth surface; from cystic tumor by its hardness and absence of fluctuation.

The prognosis is unfavorable as to cure, but favorable as to the duration of life. They grow slowly and cause but little inconvenience. Like other tumors, however, they may give rise to uterine, rectal, and vesical troubles, especially when lodged in the pelvis.

The treatment should be directed to the relief of symptoms. It is only under special circumstances that recourse should be had to operative measures for their removal.

Cancer of the Ovary.

Cancer of the ovaries occurs but rarely as a primary disease, though it is not unfrequently seen as an affection secondary to cancer in other organs. Every form of cancer has been met with in the ovaries; but there is some difference of opinion as to whether the gelatinous or encephaloid variety of the disease be the more common. It occurs in two forms, either as nodules growing in the ovary, which may attain a large size, or as a diffuse infiltration of the whole organ. Cancer may grow also in ovarian and dermoid cysts. Cancerous tumors of the ovary vary in size from that of a walnut to that of a man's head. They generally, but not always, contract adhesions to neighboring organs, and consequently become fixed and immovable.

The symptoms of the disease other than those of an innocent tumor are, tenderness, pain, like the pain of cancer in other parts, rapid growth of the tumor, œdema of the pudendum, and of the lower limb on the affected side, depreciation of the general health, cancerous cachexia, and great ascites. The treatment is purely palliative.

Sarcoma is an extremely rare disease of the ovary. It appears as the spindle-celled variety, and affects both sides. It presents a cavernous structure owing to enlargement of the vessels. The only case I have seen presented a cystic character. Myo-sarcoma has been described by Spiegelberg.

It runs a rapid course, and ends fatally.

The diagnosis is difficult. Its rapid growth, tenderness, and early ascites point out its malignant character. It is said to be distinguished from cancer by the absence of metastasis; but in the only case seen by me, and already referred to, there were secondary deposits in the lung and kidney.

The treatment is palliative.

Papilloma of the ovary has been observed. It is accompanied by great ascites.

Tubercle of the ovary has no significance, except as a part of general tuberculosis.

[SPERMATORRHŒA.

By Henry Hartshorne, M.D.

Of affections of the male genital organs, that which is most likely to come under the notice of the medical practitioner (other disorders of the same parts being usually consigned to the surgeon or the specialist) is Spermatorrhœa.

Synonyms.—Gonorrhœa[1] vera; Pollutions; Pertes séminales.

Definition; Symptoms.—Although described by Lallemand and some other writers, a continuous flow (stillicidium) of seminal fluid has not been proved ever to occur. The most common disorder deserving the name of Spermatorrhœa, is a morbid and exhaustingly frequent recurrence of involuntary seminal discharges; accompanied nearly always by more or less erection, sensation, and ejaculation. Most usually, these involuntary discharges take place at night, during sleep; with or without erotic dreams. Sometimes, in the daytime, semen escapes at the time of urination and defecation. Rarely, apart from those functional actions, will diurnal pollutions occur, without at least some more or less slight physical or mental excitation; as, jolting in a carriage or horse-car, or riding on horseback, amorous conversation, or lascivious reverie. But for the positive statements of a few observers,[2] I should doubt the occurrence of seminal discharges without ejaculation, in any case except (possibly) that of distension of the *vesiculæ seminales* under intense sexual excitement, not otherwise relieved. In cases in which semen is proved by microscopical examination to be present in the urine, the absence of recent coitus or self-abuse needs to be established; and for this, the word of the patient is not nearly always sufficient. In no other class of diseases is it so difficult to obtain a true and full history of every case, as in those of the sexual organs, male or female.

Real Spermatorrhœa, as above defined, *i. e.*, morbidly frequent involuntary seminal discharges, we must believe to be not very common. Undoubtedly it is physiological, and with continent men otherwise in good health harmless, to have an involuntary seminal escape during sleep as often as once in two or three weeks. There are those whose stamina will not bear even so much as this without disadvantage. For these, such an occurrence may be regarded as relatively pathological. But we are not entitled to bestow the name of a positive disease, unless the seminal losses are decidedly frequent, and are attended by signs of resulting debility or disturbance.

Lallemand,[1] it is true, asserted that, in a number of patients, diurnal pollutions occur habitually, without sensation, or more than an almost imperceptible ejaculation. But there is good reason to believe that there has been, in such instances, a mistaking of gleet (blennorrhœa), or of a mere escape of the fluid of the prostate, and of Cowper's glands, for seminal discharges. Under sexual excitement, it is not abnormal for a considerable amount of the latter secretions to flow, for a time, from the urethra. Only when *spermatozoa* are found, by aid of the microscope, in the fluid passed, have we reason to consider the case one of Spermatorrhœa.

When this morbidly excessive loss of seminal fluid does occur, its effects are like those of extreme venereal indulgence or self-abuse. Paget's statement[2] can hardly be accepted, however, to the effect that "masturbation does neither more nor less harm than sexual intercourse, practised with the same frequency, in the same conditions of general health, and age, and circumstances." The unnatural violence of self-abuse, in the absence of the normal physiological conditions of sexual union, induces greater disturbance both of the vascular and nervous systems. So far as the loss of seminal material is concerned, of course the results are the

[1 The term gonorrhœa is etymologically very ill-suited to its common use, as applied to a specific and contagious disease communicated by impure sexual intercourse. This affection ought to be called, if usage in such a matter could be changed, *blennorrhœa luodes, fluxus venereus*, or *urethritis contagiosa;* as *gonorrhœa* is exactly synonymous with spermatorrhœa.]

[2 *E. g.*, Beard, N. Y. Med. Record, June 14, 1879, p. 556; Roberts, Urinary and Renal Diseases, Am. Edition, p. 166.]

[1 Des Pertes Séminales, &c., Paris, 1837.]

[2 Cited by Bartholow, in his monograph on Spermatorrhœa, N. Y. 1879, p. 12.]

same. Small as is the actual quantity of the discharge in either case, there is reason for considering it (including the sperm-cells or spermatozoa) the most highly elaborated of all secretions in the body; so that its loss counts for much more than an equivalent escape of any secretion, or of the blood itself.

Subjects of Spermatorrhœa are usually pale or sallow, sometimes with a dark space under the eyes, a languid or haggard expression, indisposition to look one in the face, and ready flushing under excitement or embarrassment.[1] The hands are apt to be cold and moist (palmar ephidrosis). Acne is spoken of by authors as a sign of this affection or of habitual self-abuse; but I do not believe that it has any significance of that kind. Nor is the above-mentioned physiognomy at all decisive. Anæmic persons of a nervous temperament may, under some circumstances, exhibit all these appearances without any such causation. Still, with a history pointing in this direction, such signs need to be observed. This is true also of a disposition to make water frequently, and of jerking of the feet or hands, sometimes when awake, but much more often during sleep. The pulse of the subject of Spermatorrhœa is almost always abnormally rapid, and the heart is liable to palpitation.

A morbid mental state is connected with such a condition, and is apt to be the most serious part of the case. The mind is deficient in concentration; attention wanders, will is weak, timidity and irresolution prevail; the memory is feeble, and there is a proneness toward day-dreaming, especially upon sexual or sensual subjects. Moreover, the patient is inclined to dwell morbidly and with gloomy apprehensions upon his own state.

Imaginary Spermatorrhœa is a name fitly given to those cases which really constitute a majority of those in which the practitioner is called upon to give advice. Misled by popular ideas, and stimulated by advertisements and books of quacks who make them their prey, many men who have indulged in unnatural or natural excesses mistake a trifling gleet for Spermatorrhœa, or become alarmed on account of nocturnal involuntary discharges taking place at considerable intervals. Melancholy of an aggravated degree sometimes attends this habit of mind; even suicide is said to have resulted from it. Hardly can this be supposed to take place, however, without some predisposition to insanity having before existed.

Causation. — Spermatorrhœa is the result of long-continued habitual and excessive self-abuse in a very large majority of cases. Venereal excess, in natural coitus, accounts for almost all the remaining instances. Spinal disease, as locomotor ataxy, &c., sometimes appears to have frequency of seminal discharges as a symptom. I doubt the validity of the evidence asserted in favor of any other causation beyond these as, *per se*, ever sufficient. In the works of Lallemand and others, it is true, we read of various other causes; as, gout or rheumatism of the genital organs; constipation; hemorrhoids; fissures of the anus; ascarides in the rectum, &c. But I doubt the occurrence of true Spermatorrhœa in any case from these, unless excess in venery or self-abuse coexisted with them. There is importance in this conclusion in regard to the etiology of the disease, since it gives strength to the urgency with which the medical adviser must, whatever account the patient gives of his habits, insist upon the absolute avoidance of indulgence, most of all of self-pollution, in order to a cure.

Morbid Anatomy and Pathology. —Lallemand's treatise, already mentioned, furnished for many years the common stock of assertion upon this topic. He referred Spermatorrhœa to irritation or inflammation of the prostatic part of the urethra and of the seminal ducts. Raige-Delorme[1] mentions, as having been found in autopsies coincident with Spermatorrhœa, ulcerations of the orifices of the ejaculatory ducts, or of the ducts themselves, or of the vesiculæ seminales; vascular injection of the same parts, or purulent deposits in them, or in the epididymis or testicle. But, as Dr. Bartholow[2] remarks, there is no proof of anything more than a coincidence in such cases, and negative examples are abundant. Sir Henry Thompson[3] denies the fact of the production of prostatic inflammation by excessive sexual indulgence.

All the facts in the history of Spermatorrhœa point to the conclusion that it is dependent essentially upon a *neurosis*, involving the genital apparatus, along with the centre of its reflex action, located, according to recent physiological inquiry, in the lumbar portion of the spinal cord. While erection is feeble, and practical im-

[1 Technical words are here employed by a few writers, which are not necessary, and, if used, cannot be monopolized for application to cases of any one causation: viz., *anthropophobia*, shrinking from the society of other human beings; *agoraphobia*, fear of entering or crossing a large open space, *e. g.*, a wide street or a public hall.]

[1 Dictionnaire de Médecine, tome xxviii. p. 506.]

[2 Op. citat. p. 19.]

[3 On Enlarged Prostate, &c. p. 195.]

potence exists from premature ejaculation during attempted intercourse, the excito-motor susceptibility of the organs is exaggerated, sometimes to an extreme degree. The amount of semen passed at once in such cases is generally small, although the actual discharge may be made tolerably copious by the addition of the secretion of the prostate and of Cowper's glands, or of mucus from the urethra. That local irritation, even inflammation, of the urethra, vesiculæ seminales, and testicle may coincide with Spermatorrhœa in some instances, is not at all to be denied. The excess or abuse which causes the latter may also easily induce the former. "Irritable testis," under such associations, was described by Sir Astley Cooper, in his work on the Testis.[1] Enlargement of the veins of the penis, and varicocele of the cord, are also mentioned by authors in the same connection; but there is no proof of their being either direct causes or results of Spermatorrhœa.

Diagnosis. — As already intimated, while the account of the patient may of course be taken as to the frequency of discharges with ejaculation, nocturnal or diurnal (except the often needful reserve in regard to his voluntary habits), in all cases of a more obscure and doubtful kind, microscopic examination alone can give certainty. Spermatozoa found upon the linen or in the urine, will alone prove a urethral discharge to consist of or to contain seminal fluid.

Fig. 102.

Spermatozoa.

The spermatic filaments are about $\frac{1}{500}$ of an inch in length, having a head of an oval form, about $\frac{1}{1000}$ of an inch in breadth. While living, they are in incessant motion. In urine, however, they are always dead.

They may remain alive in the female genital organs for hours; occasionally, it is said (perhaps doubtfully), for days.

[1 London, 1830, chapter iv.]

Their forms may be preserved in urine for many days, even for weeks.

When spermatozoa are found in a specimen of urine, we still need evidence to give assurance of their *involuntary* discharge; as, shortly after either coitus or self-abuse, some semen will continue to flow through the urethra and will be passed in urination.

No other forms met with in urine present much resemblance to spermatozoa, unless it be *vibriones*. But these occur only when putrefaction has commenced; they are much smaller than the spermatic filaments ($\frac{1}{300}$ of an inch in length), are greatly more numerous, and have not the characteristic distinctness of "head" and "tail" which those present.

Fig. 103.

Vibriones.

Hassall,[1] Flint,[2] Chambers,[3] Bartholow,[4] and Beard[5] are among those who attest the frequency of the mistake of confounding a blennorrhœal discharge from the urethra with true Spermatorrhœa.

Prognosis.—There is nothing in the nature of Spermatorrhœa either to assign to it a definite period of duration, or to render it incurable. Having its origin nearly always in continued habitual self-abuse, the cessation of this may be generally expected to make relief practicable, in the course of a few weeks or months. If it be otherwise in certain cases, in the absence of organic disease of the spinal cord, anæmia and general debility will probably account for the delay; and, with proper care on the part of the patient, these conditions will mostly be found amenable to treatment. We ought, therefore, always to encourage patients to anticipate recovery; especially as mental depression is, in many instances, the most difficult part of the affection to remove.

When Spermatorrhœa occurs as a symptom of locomotor ataxia (which is, after all, an exceptional occurrence), its exist-

[1 Urine in Health and Disease: London, 1863.]

[2 Practice of Medicine, &c.]

[3 Lecture on Gonorrhœa and Imaginary Spermatorrhœa: Lancet, 1861.]

[4 Op. citat. p. 39.]

[5 N. Y. Med. Record, June 14, 1879, p. 555.]

ence is likely to be confined to the earlier period of that disorder; although, in this, there is no rule which can be positively insisted upon, either on the ground of pathology or of clinical experience.

TREATMENT. — Our view, above expressed, of the usual origin of Spermatorrhœa, points at once to its chief means of cure. Self-abuse must be abandoned. Like other confirmed habits, and as much as any other, this may present great difficulty.[1]

Fig. 104.

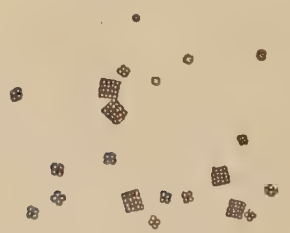
Epithelial Cells from Bladder, Ureter, and Pelvis of Kidney. (Roberts.)

Fig. 105.

Mould Fungus; Sporules and Thallus.

The patient must be taught to assist his will in this respect, not only by the highest moral and prudential considerations and motives, but by self-management. Active exercise in the open air should be urged; his time should be constantly occupied; and solitude should be avoided. Let him go to bed always somewhat (though not excessively) fatigued. His bed-covering should be comparatively light, and the bed not too soft. Rising early is to be advised, as the most common time for involuntary pollution is during the last hour or two of morning sleep. The diet should be nourishing and digestible, but not stimulating. Highly seasoned food of every kind should be avoided. Total abstinence from alcoholic liquors, tobacco, and coffee should be enjoined. Tea may be allowed, but in great moderation, especially at night. The last meal taken should be a spare one, and very little fluid should be drunk near bedtime, as a full bladder may promote genital reflex irritation. Quite as important as any of these precepts will be that of the avoidance of all causes of erotic feeling or ideation. Books, pictures, conversation, and day-dreams upon sexual subjects must be entirely eschewed. On the other hand, social intercourse with pure and refined women will, by elevating the tone of feeling, tend to restore the lost balance of the system. There is no doubt, however, that some of the amusements which are popular, and some usages of society, make more easy the fall of young men into destructive habits. The ballet and melodramatic pantomime, the waltz, and the "German" excite sexual feelings and impulses for which, with the unmarried, there is no legitimate gratification. "Seminal plethora," with those who are thus subject to strong excitation and yet are continent, may occur. Mostly, this

Fig. 106.



Sarcinæ in Urine.

[1 In inveterate cases, Hilton has found that the habit can be always broken by applying to the penis a strong solution of iodine, or blistering fluid, making the prepuce too sore for manipulation. (Roberts, op. citat. p. 168.]

finds relief by involuntary nocturnal discharges. If not, weight and pain of the testicles, turgescence of the spermatic cords, headache, and general malaise, may result. But the temptation, of course, is strong to indulge, instead, in illicit intercourse or self-pollution. There are some physicians who, under a dread of the effects of the latter, have gone so far as to recommend a resort to houses of prostitution as a hygienic measure. Even if it were not a question of morals at all, this

Fig. 107.

Extraneous matters found in Urine. *a*. Cotton-fibres. *b*. Flax-fibres. *c*. Hairs. *d*. Air-bubbles. *e*. Oil-globules. *f*. Wheat-starch. *g*. Potato-starch. *h*. Rice-starch granules. *i*. Vegetable tissue. *k*. Muscular tissue. *l*. Feathers.

must be considered as bad advice. Irregular sexual intercourse does not lessen, but rather cultivates, that pruriency in which the habit of masturbation originates, and by which it is sustained. The true cure for slavery to this propensity is to be found in manly exercise and incessant occupation, away from all provocatives of sexual desire. Marriage is altogether different from unlawful venery in its effects in this respect, by reason of the expansion and elevation of interests which it involves. It may be commended, from the hygienic and therapeutic standpoints, as a general rule.

Anæmia is common in the subjects of Spermatorrhœa. Iron is therefore usually indicated; especially the tincture of the chloride. When wasting of the body is marked, cod-liver oil also may be advised. Sea bathing, or mountain air may, when accessible, be recommended. In very weak cases, strychnia, or even phosphorus, may be cautiously prescribed. Electricity, applied to the spinal and perineal regions, is reported of favorably by several authorities (Schultz, Benedikt, Dicenta, Beard).

For anaphrodisiac effect, with a view of directly checking involuntary seminal discharges, the remedies most approved are bromide of potassium, belladonna or atropia, lupulin and gelsemium. Ergot has sometimes also been so employed, as well as minimum doses of cantharides. Hydrate of chloral[1] has been said to do good in some instances.

[1 Bradbury: Brit. Med. Journal, April 8, 1871.]

Of bromide of potassium, for this purpose, 20 grains in one dose, at bedtime, may be given; to be increased afterwards if found necessary. Of atropia, Stephanides[1] has used with advantage a single evening dose of $\frac{1}{100}$ of a grain. Lupulin acts, perhaps with less approach to certainty, in 10 to 15-grain doses. Beard[2] prefers the hypodermic injection of atropia. Bartholow[3] speaks well of the effect in such cases of gelsemium. One of his combinations consists of tincture of gelsemium, one drachm, with tincture of belladonna, two drachms; of which the dose is 15 drops three times a day.

Local treatment for Spermatorrhœa is especially associated with the name of Lallemand. Dr. Bartholow shows, however,[4] that the *porte-caustique* originated with Ambrose Paré, and was used by Loizean (for stricture, his patient being Henry IV. of France), Wizeman, Hunter, Everard Home, Ducamp, and Amussat. Its employment in Spermatorrhœa grew out of Lallemand's suppositious, and, it is now believed, erroneous, pathological theory of the affection; namely, that it depends chiefly upon a morbid state of the prostatic portion of the urethra. The instrument is designed to impress the action of solid nitrate of silver directly upon that locality; the caustic being shielded until it has been introduced to the right spot, and then exposed and immediately withdrawn. A good deal of irritation results, requiring rest in bed, diluents, &c. This operation is not free from danger. Golding Bird has reported a case of dangerous cystitis from it; Sir H. Thompson asserts that it may produce inflammation of the prostate; and Chambers[5] mentions the occurrence of death from the application in a similar way of an irritant ointment upon a catheter. Acton[6] prefers cauterization by means of a solution of nitrate of silver, ten grains to the ounce, introduced by means of a syringe prepared for the purpose.[1]

Since no demonstration of the correctness of Lallemand's pathology has been obtained, it may well be believed that this method of treatment is not rational; and it has certainly very often failed to produce more than a merely temporary effect. Romberg and others assert its value in some cases, particularly those of imaginary Spermatorrhœa, by reason of its moral or mental influence; working upon the expectant confidence of the patient.

Where the habit of masturbation seems to be impossible to break, and especially when a long prepuce favors it by maintaining great sensitiveness in the glans penis, *circumcision* appears to be a warrantable operation. The antiquity of this procedure is very great. Herodotus mentions it as practised by the ancient Egyptians. Among the Jews, it dated back before Moses, to the time of "the fathers."[2] Travellers have found it to exist amongst various tribes of savages, in remote parts of Africa and elsewhere. Of its original hygienic as well as moral purpose, there seems to be evidence. Not always, however, will even this severe measure succeed in putting an end to long-indulged salacity and self-abuse.

Other mechanical means have been recommended and used for the prevention of the wasting discharges of nocturnal Spermatorrhœa. Of these, probably the most successful is a leather ring (to be placed around the penis) armed with metallic points, which, when erection occurs, will awaken the patient.

Our concluding observation, however, needs to be, that, in regard to Spermatorrhœa, the strongest emphasis must be placed upon its *neurotic* origin and pathology; and the resulting importance of preventive treatment, in which *moral* and *mental regimen* must always be predominant.]

[1 Journal des Sciences Médicales, 1880, p. 36; and Schmidt's Jahrbücher, No. 8, 1879.]

[2 N. Y. Med. Record, June 14, 1879, p. 557.]

[3 Op. citat. p. 115.]

[4 Op. citat. p. 79.]

[5 Lancet, 1861, p. 582.]

[6 On the Reproductive Organs, Philada. Ed. p. 243.]

[1 See Bartholow's work, already cited (p. 89), for an account of the instruments most available for this use.]

[2 John vii. 22.]

DISEASES OF THE CUTANEOUS SYSTEM.

EXANTHEMATA.
SQUAMÆ.
PAPULÆ.
VESICULÆ.
PUSTULÆ.
BULLÆ.
TUBERCULA.
MACULÆ.
SYPHILIDA.
ANIMAL-PARASITE DISEASES.
VEGETABLE-PARASITE DISEASES.
FOREIGN DISEASES.

DISEASES OF THE SKIN.

BY A. BALMANNO SQUIRE, M.D.

INTRODUCTORY.

IN our account of the diseases of the skin we shall adhere in the main to the classification proposed at the beginning of this century by Dr. Willan. Firstly, because his classification is the one that will be the most familiar to our readers. Secondly, because it has never been supplanted in general estimation by any of the numerous systems that have since been propounded. And thirdly, because, although it is obviously imperfect (for it is an arbitrary, not a natural arrangement), we think it to be still the best medium for obtaining a clear and practical knowledge of the diseases of the skin. Cutaneous pathology has not so far advanced since Willan's time as to demand a thorough revolution in this department of medicine. But it has nevertheless made sufficient progress to require some modification of the classic system which has so long stood its ground both in this country and abroad, and whose popularity has survived so many formidable attacks.

The alterations which may be said to be *required* by the present state of science consist in the addition of three new genera, the diseases comprised in which were formerly distributed amongst the eight genera described by Willan, and were confused with other diseases from which they are known to be distinct in causation, appearance, and indications of treatment. We shall accordingly add to the items of Willan's classification (Exanthemata, Squamæ, Papulæ, Vesiculæ, Pustulæ, Bullæ, Tubercula and Maculæ), the following, viz., Syphilida, Animal-parasite eruptions, and Vegetable-parasite eruptions. And we shall make one more alteration, which we think will facilitate the attainment of a clear view of our subject, viz., the further elimination from Willan's genera of all diseases that are utterly foreign to this country, which diseases we shall group by themselves at the end of our list.

With this preface we may proceed at once to display our system of classification, and to describe the diseases included by it.

CLASSIFICATION.

EXANTHEMATA—
Erythema, Roseola, Urticaria.

SQUAMÆ—
Psoriasis, Pityriasis, Ichthyosis.

PAPULÆ—
Lichen, Strophulus, Prurigo.

VESICULÆ—
Eczema, Herpes.

PUSTULÆ—
Ecthyma, Impetigo.

BULLÆ—
Pemphigus, Rupia.

TUBERCULA—
Lupus, Cheloid, Verruca, Acne, Molluscum.

MACULÆ—
Nævus, Lentigo, Ephelis, Vitiligo.

SYPHILIDA—
Vegetative, Exanthematous, Vesicular, Squamous, Papular, Pustular, Bullous, and *Tubercular Syphilides.*

ANIMAL-PARASITE DISEASES—
Scabies, Phthiriasis.

VEGETABLE-PARASITE DISEASES.
Tinea favosa, Tinea tonsurans, Tinea decalvans, Sycosis, Chloasma.

FOREIGN DISEASES—
Elephantiasis Græcorum, Elephantiasis Arabum, Framboesia, Pellagra, Malum Alepporum.

SECTION I.—EXANTHEMATA.

The Rashes, or Exanthemata, are Erythema, Roscola, and Urticaria.

ERYTHEMA.

Synonyms.—Inflammatory Blush. Erythème, Dartre érythémoïde, Hautröthe, Rothlausgeschwulst, Rubor, Combustio.

Definition.—Erythema (ἐρυθήμα, redness) occurs as circumscribed stains of a red color occupying a limited portion of the skin. These patches of inflammatory redness are the seat of tingling, pricking, and smarting sensations.

Erythema may be described as of two kinds, viz., the local and the constitutional.

Under the term LOCAL ERYTHEMA are included the following varieties:—

E. simplex, E. intertrigo, E. leve, E. paratrimma, and *E. pernio.*

The varieties of CONSTITUTIONAL ERYTHEMA are:—

E. nodosum, E. papulatum, E. circinatum, and *E. fugax.*

Local Erythema.

ERYTHEMA SIMPLEX lasts usually only a few days.

Causes.—Local irritants of various kinds, such as a mustard-poultice, an irritating plaster, or the friction of the dress, producing a chafe.

In the coup-de-soleil, or sun-stroke, which, rare in this country, is so common and so fatal an accident in tropical climates, an erythema of the face and hands is commonly the first symptom (*E. solare*).

But E. simplex is most commonly the result of irritating secretions flowing over the skin. Thus it may be produced on the cheek by the discharge from the eyes in purulent ophthalmia, or in infants on the buttocks by neglect of cleanliness, or on the upper lip by the flow of acrid discharge from the nostrils during a cold, or in any situation by the discharge of pus from an ulcer or sinus.

Diagnosis.—Simple erythema of the buttocks of infants is frequently mistaken for infantile syphilis. But in the latter disease the eruption is of a ham-colored tawny hue, and is often complicated with "mucous tubercles" around the anus and an inelastic cracked appearance of the soles and palms. It is accompanied too with snuffling at the nose and a peculiar alteration of the infant's cry.

Treatment.—The treatment of E. simplex consists in the removal of the offending cause and the use of some mildly astringent application, such as cold-cream or weak lead-lotion.

ERYTHEMA INTERTRIGO (*Intertrigo*, a chafe-gall) is only found where two opposing surfaces of the skin are in contact. For example, in the armpit, under the buttocks, under the breasts, or between the toes. It is especially liable to happen in stout people, and in them may occur in the groins or in the folds of skin about the neck. It is most common in fat infants and in stout persons, especially women of the age of from forty to fifty, and more particularly adults of the lymphatic temperament, or in children of scrofulous constitution. In these last it may be accompanied with a copious thin mattery discharge (Purifluent Erythema).

Description.—The rash begins in a rose-colored line at the bottom of a fold of skin; it gradually extends over the whole of the crease or fold. From the resulting red surface exudes a thin, ill-smelling discharge, which is usually serous, but is occasionally purulent.

Intertrigo is accompanied with a feeling of heat and of other disagreeable sensations.

It not unfrequently lasts for some time, being often kept up by the constant rubbing that the disagreeable sensations in the part provoke. In corpulent people who are of uncleanly habits E. intertrigo may pass into the chronic state, and superficial ulcers with pale exuberant granulations may take the place of the original rash.

The *Treatment* of this variety of Erythema consists in separating the contiguous surfaces by keeping a piece of scorched rag between them, or in dusting them over with some soft impalpable powder, such as violet-powder or lycopodium-dust, which absorbs the irritating moisture; or the secretion may be constantly kept away by frequent washing of the surfaces, or may be checked by the use of astringent lotions. Painting the surface with tincture of iodine often has a very excellent effect.

ERYTHEMA LEVE is produced when the skin stretched over an œdematous part inflames. This variety of Erythema occurs for the most part in the legs, but when the patient is confined to bed it may occur in other (dependent) situations.

Description.—It appears as smooth,

shining red spots, accompanied with increased swelling of the subjacent areolar tissue. This variety of Erythema derives its importance from the tendency of the patches to terminate in gangrene of the affected skin and of the subjacent areolar tissue. When this is about to take place the patches assume a purplish hue, and serous blebs are formed over them.

The *Treatment* of E. leve consists in removing the cause (œdema) by diuretics, sudorifics, or aperients, by position or by acupuncture, and in using stimulating applications, such as camphorated spirit or tincture of iodine, to the erythematous patches.

ERYTHEMA PARATRIMMA (or the *Bedsore*), happens in the course of debilitating diseases that confine the patient long to bed, such as typhus, or typhoid fever, or paralysis of the lower half of the body.

The common position of the bedsore is over the sacrum, but it is occasionally situated over either of the trochanters or of the iliac crests.

Description.—It appears at first as a diffused dusky redness of a limited portion of the skin, attended with a sensation of pricking; sometimes serous blebs are developed on the reddened surface; soon the affected skin becomes blackened, and a more or less extensive slough forms, which sometimes extends very deeply.

The *Treatment* consists in the removal of pressure from the affected skin; in preventing the flow of irritating secretions over it; in a scrupulous attention to cleanliness, and in the local use of stimulating applications.

If a slough has formed, its separation should be favored by the application of yeast poultices. After the separation of the slough, the ulcer should be dressed with some moderately stimulating ointment.

ERYTHEMA PERNIO (or the *Chilblain*) is a disease almost peculiar to children and young persons, affecting especially those who are of lymphatic temperament.

Chilblains are most common in children under ten years of age. The usual situation of chilblains is on the backs of the toes and of the fingers, although after puberty they are found also on the nose. They happen generally after a thaw, or as a consequence of warming the hands or feet by the fire when they are cold and damp; in some individuals they appear regularly every winter, disappearing in the spring.

Description.—Chilblains appear as shining, red, swollen patches which are the seat of severe itching and tingling, and are extremely sensitive to even the slightest pressure. These after continuing for a few days may gradually subside, leaving only a slight scurfiness of the affected skin.

But if they persist for many days, the reddened patches assume a bluish tint and become surmounted by the watery blebs or "blains" from which the complaint derives its name.

These blebs become ruptured and ulceration takes place, and so a foul-looking wound with ragged edges and a slough-like floor is produced in the situation of the erythematous patch. This ulcer (commonly known as the broken chilblain) is sometimes pretty deep, and is always slow to heal.

In the *Treatment* of chilblains, measures must be adopted to increase the activity of the general circulation by a generous and stimulating diet, active exercise, frictions of the skin with hair-gloves, &c.; and at the same time activity of the circulation in the affected part should be specially promoted by the use of stimulating applications, such as soap-liniment or camphor-cerate. If the chilblain be "broken" resin-ointment will be a suitable dressing; poultices are to be avoided if possible.

Rheumatic Erythema.

Under this heading are included all except one of the varieties previously enumerated as coming under the category of constitutional Erythema.

ERYTHEMA NODOSUM is a disease almost peculiar to young persons, more particularly those of lymphatic temperament. It attacks especially young girls, in whom it is frequently associated with amenorrhœa and chlorosis. It is the most common of the three varieties of rheumatic Erythema. It appears to be sometimes occasioned by fatigue, exposure to cold, and insufficient nourishment.

The appearance of the eruption is usually preceded for a few days by slight feverishness and rheumatic pains in the joints. These pains often continue with the eruption and may even outlast it. They are sometimes very severe.

Description.—The eruption affects almost invariably the legs, attacking especially the fore-surface of the leg, but it occurs sometimes on the backs of the forearms and on the thighs.

It presents the appearance of red, elevated patches of an oval form. The long diameter of the patch is generally parallel with the axis of the limb. The patches vary from an inch to three inches in diameter. They are palpable swellings, but their margin is ill-defined. At first they are hard and tender to the touch, and are of a rose-red color, but in a few days they soften and change to a violet color; in a few days more this fades into a yellow tint, and the elevation disappears.

Each patch lasts on the average a

week, but the disease is generally by a succession of patches prolonged for two or three weeks.

Treatment.—The treatment of E. nodosum should be commenced by a dose of aperient medicine. The patient should be put to bed, or at all events directed to lie on a sofa most of the day. Quinine conjoined—if there be much anæmia—with iron should be taken regularly in tolerably large doses, and if there be any indication of a scrofulous taint, the addition of cod-liver oil will be of service.

Erythema papulatum differs from E. nodosum only in the much smaller size of its patches, which rarely exceed the size of a split-pea, and in the situations occupied by it (the face, neck, breast, and arms). In every other respect its history is that of E. nodosum, and it demands the same treatment. It is of less common occurrence than E. nodosum.

Sometimes the spots are larger, from the size of a sixpence to that of a shilling, and proportionately elevated; they are then apt to occur also on the legs (E. tuberculatum). Such spots form a connecting link between this variety and the preceding one.

Erythema circinatum appears at first as small round patches, slightly raised above the level of the surrounding skin. These gradually spread at their circumference, and at the same time fade at their centre, and so assume the form of red embossed rings, the outer margin of the ring being abrupt and well-defined, while the inner edge of the ring is gradually shaded off. The area inclosed by the ring is of a faded yellow color. The breadth of the ring itself varies from a quarter to half an inch; generally several rings are developed one after another, some of them may attain a diameter of several inches. After they have spread to a certain extent, portions of the rings are apt to fade, and the remaining portions, uniting with similar fragments of other rings, form with them variously-curved lines.

This variety of Erythema is confined generally to the trunk. It lasts about a week. It is not a common eruption. It sometimes occurs in the course of an attack of acute or subacute rheumatism. It requires the same treatment as E. nodosum.

[Among the soothing applications often useful in different forms of Erythema (as well as other irritative cutaneous affections) are *glyceramyl* and *vaseline*. Glyceramyl is a compound of glycerin and starch[1] mixed together with the aid of heat. Vaseline (essentially the same as cosmoline or unguentum petrolei) is one of the "soft paraffins" obtained by destructive distillation from coal oil. It has the great advantage of not becoming rancid with keeping. Ozokerin is another preparation of the same class.—H.]

[1] A fluidounce of glycerin to a drachm of starch.]

Dyspeptic Erythema.

Erythema fugax is characterized by the sudden appearance of large red patches usually on the face, but sometimes on other parts, namely, on the arms and upper part of the trunk. After remaining out for a few hours they as suddenly disappear. In a day or two they reappear either in the same place or in a new one.

This eruption forms the connecting link between Erythema and Urticaria, and is by some writers included under the latter heading. It is generally brought on by some error of diet.

The *Treatment* of it consists in remedying whatever disorder of the digestive organs may be the cause of its appearance.

Roseola.[1]

Synonyms.—Rose-rash; False Measles; Roseole; Fièvre rouge; Eruption rosacée; Fausse rougeole; Rötheln; Rotherhund.

Definition.—Roseola, Roseus, rosy, is a rash which presents the appearance of a diffused mottling of the skin spread over a considerable extent of surface; the mottling being produced by small rose-colored patches, which, running into one another, inclose islets of unaffected skin.

Causation.—Roseola is more common in the summer (R. æstiva) than in the winter, and seems to depend often on the disorder of the stomach and bowels so common at that season.

It is of commoner occurrence in infants (R. infantilis), than in children or grown-up persons, being provoked often by the disorder of the alimentary canal that very frequently attends the first dentition.

In infants the patches are smaller and more closely arranged than in the adult.

In adults it is sometimes excited by the drinking freely of cold water after violent exertion.

Roseola is sometimes occasioned by vaccination, and sometimes occurs in the course of smallpox, and other exanthemata.

Description.—The eruption of Roseola is preceded for a day or two by slight febrile disturbance, which subsides as the rash becomes developed, and there is commonly some dryness and redness of the fauces.

[1] See also vol. i. Art. Roseola.

The network of inflammatory redness presented by roseola may commence on the chest, the belly, or the upper limbs, and may remain limited to either of those regions, or may spread all over the body.

The duration of the rash is very brief. After persisting for three or four days it fades away, leaving sometimes a slight scurfiness of the affected skin. Its color is deepest on the second day.

When Roseola is produced by vaccination (R. vaccinia), it appears at the same time that the "red areola" forms around the vaccine vesicles, and spreads from the "areola" over a considerable extent of surface, sometimes even covering the whole of the body. Its appearance increases the (usually) slight febrile disturbance that accompanies the formation of the "areola."

When Roseola occurs in the course of smallpox (R. variolosa), the appearance of the proper smallpox eruption is delayed, the roseolous rash appearing at the time that the pustular smallpox eruption should, and for two or three days taking the place of it. This occurrence is more common in inoculated than in natural smallpox.

The variolous Roseola, like the ordinary eruption of smallpox, spreads from the face and chest to the extremities. It is sometimes so abundant that the affected surface looks almost uniformly red, and the case is then very apt to be mistaken for scarlatina. But the appearance of the pustular smallpox eruption very soon corrects an error of this kind.

Diagnosis.—Roseola is so apt to be mistaken for measles as to have received the name of *false measles*. In either disease there is a diffused rash all over the body, interspersed with intervals of natural skin.

The rash of measles is, however, of a mulberry rather than of a rose color. Its reddened patches exhibit a crescentic shape. They appear first on the forehead, whereas Roseola may commence on other parts of the body, and when it begins on the face, spreads from the neighborhood of the nose.

There is (in measles) more severe disturbance of the system. The feverishness precedes the eruption for three days (instead of only one). The eyes are swollen and watery in measles; and, lastly, measles is a very highly contagious disease, which Roseola is not.

"Syphilitic roseola" may be distinguished from Roseola properly so-called by the dusky and sombre hue of the rash, by the absence of itching, by the longer continuance of the rash, and by the more serious character of the throat-lesion when the throat is affected.

Prognosis.—Roseola is generally a brief and trivial disorder, occasioning but little inconvenience, and terminating within a week after its commencement. Sometimes, but very rarely, it assumes a chronic form, appearing and disappearing at uncertain intervals.

Treatment.—Roseola is a disease which, on account of its trivial character and its usually brief duration, does not require very active interference. Indeed it derives its chief importance from its liability to be confounded with other more serious complaints. A restricted and simple diet, gentle saline aperients, and a few warm baths, are in most cases all that is required.

If there be much acidity of the stomach, magnesia is indicated.

In infantile Roseola, if the gums be hot and tender, they should be lanced.

When the disease is chronic, the internal administration of dilute nitro-hydrochloric acid is of service, but sometimes a change of air and a course of sea-bathing are necessary.

URTICARIA.

Synonyms.—Nettle-rash; Nettle-fever; Fièvre ortiée; Porcelaine; Nesselausschlag; Nesselfieber; Cnidosis; Uredo; Porcellana; Aspretudo; Febris urticata; Essera; Lora.

Definition.—Urticaria (*Urtica urens*, the stinging-nettle) is an eruption which resembles the effect produced on the skin by the contact of the stinging-nettle, and which is accompanied by the burning, tingling sensation that the sting of the nettle occasions. It is characterized by evanescent cutaneous elevations called "wheals" or "pomphi," which may be described as circumscribed swellings of the skin, more or less hard, sometimes whiter, sometimes redder than the healthy skin. They are sudden, both to appear and to disappear.

Causes (Predisposing).—A special predisposition or idiosyncrasy; infancy, childhood, and adolescence; fineness and delicacy of the skin; the female sex; a gouty habit.

The exciting causes of Urticaria are: the spring season; sudden exposure to cold during warm weather; high living and intemperance; over-exercise; strong mental excitement; dentition; morbid affections of the uterus and the urinary organs; derangements of the digestive organs. The ingestion of certain ailments, amongst which may be enumerated lobsters, mussels, cray-fish, crabs, shrimps, smoked or salted fish, mushrooms, cucumbers, strawberries, raspberries, honey, bitter almonds, sweet almonds, oatmeal, pickles, caviare, pork, eggs, beer, coffee, liquors, seltzer-water. The ingestion of certain drugs, such as valerian, copaiba,

capsicum, iodide of potassium and the turpentine group of drugs. The contact of certain irritants with the skin: for example, of the urtica urens, the loasa, and several other stinging plants; of some caterpillars; and of certain molluscs, such as the "Portuguese men-of-war;" the bites of gnats, mosquitoes, fleas, bugs, &c.; the irritation set up by the pediculus corporis.

But it must be remarked that the majority of the exciting causes above enumerated can operate only on persons of special susceptibility, and that people in whom Urticaria is readily excited by some of these causes are quite insensible to the operation of others. For instance, certain persons who can never eat eggs without experiencing a consequent attack of Urticaria may nevertheless be able to partake of strawberries with impunity, and *vice versâ*.

Description.—Urticaria may be either acute or chronic. In the acute form, which is the commoner, the duration of the eruption varies from a few hours to a few days; whereas chronic urticaria may last for several months, or even several years.

In either case the eruption is essentially the same. The wheals or pomphi may vary in breadth from that of a millet-seed to that of a crown-piece. When of the smallest size they present the appearance of papules rather than of pomphi, and appear more prominent than the broader patches ("Lichen urticatus"). The larger wheals often present a distinct depression at their centre. Their outline, which is always well defined, may be either regularly rounded or irregularly sinuous, so that they resemble the islands on a geographical map. Sometimes they occur in long bands (U. gyrata), and look like the marks of a whip. The surface of the wheals (excepting those of the smallest size) is flattened. The wheals are sometimes scattered thinly over the affected surface, but are sometimes so numerous and so thickly set as to become confluent (U. conferta). Their color is generally a dull white, but often a rosy or a crimson red. In either case they are commonly surrounded by a rosy areola, so that when the pomphi are at all thickly set, the areolæ of neighboring pomphi blend with one another. When the pomphi, as commonly happens, are of a dull white color, the surrounding rosy areola, which commences abruptly at the margin of the wheal, gives it a very conspicuous appearance. In regions where the subcutaneous cellular tissue is loose, the eruption may be complicated by considerable subcutaneous swelling. Thus the face and the scrotum, when attacked by an eruption of Urticaria, occasionally become so much swollen as to present a very alarming appearance.

Although the course of the eruption may extend over a considerable space of time, the duration of an individual pomphus is always very brief, varying from a few minutes to, at the most, a few hours. The sudden appearance of the pomphi, their transitory existence, and their abrupt subsidence, constitute one of the most striking peculiarities of the disease.

Varieties.—The rash may be either acute or chronic.

Acute Urticaria is of two kinds. In the one (U. febrilis), the appearance of the rash is preceded for two or three days by feverishness; in the other (U. ab ingestis), the eruption occurs within an hour or two after the ingestion of some offending substance.

In the former kind, commonly known as the Nettle-fever, the disease begins with some fever; the patient complains of headache, nausea, and pain in the epigastrium; he feels faint and languid, and his tongue is furred. After these symptoms have continued for two or three days, they are terminated by the appearance of the rash, the development of which is attended with much tingling and excessive itching. These sensations provoke the patient to rub or scratch himself, and thereby greatly to increase the eruption. The attack lasts generally a week or two, with frequent fluctuations in the condition of the rash. The wheals are usually more developed in the evening than at other times of the day. Whenever, during the course of the attack, the rash recedes, the symptoms (already referred to) which ushered it in are apt to recur.

The Urticaria ab ingestis comes on much more suddenly than an attack of Nettle-fever. It lasts a much shorter time; but, while it lasts, is a far more severe illness. It often occasions great alarm by giving rise to the supposition that the person attacked by it has been poisoned, and so indeed he may be truly said to have been, although his actual danger is by no means in proportion to the severity of his symptoms. An hour or two after the offending substance has been swallowed, pain is felt at the epigastrium. This is accompanied with nausea and faintness; there is much heat, and tingling, and intolerable itching of the skin; and soon the eruption makes its appearance. It is very confluent, and is attended with considerable subcutaneous swelling. It attacks chiefly the face, neck, and upper half of the body, but sometimes extends over the whole surface. Occasionally the mucous membrane of the mouth and pharynx is much swollen, and the patient sometimes suffers from dyspnœa, so as to seem almost on the verge of suffocation. After a few hours' duration the violence of the attack subsides, and in a day or two the patient is well again. If, as often happens, vomiting or diarrhœa occur during the course of the

attack, great amelioration is at once produced. The most alarming symptom in an attack of this kind is the occurrence of extreme prostration.

Chronic Urticaria is unattended with general symptoms. The eruption is not so violent as in the acute variety. Nor are the wheals quite so evanescent as those of acute Urticaria. However, in the chronic, as in the acute kind, the wheals have individually but a brief duration; they are constantly disappearing and giving place to others, and so seem to be always shifting their position. As in the acute (Nettle-fever) kind, the rash is constantly varying in extent; it appears and disappears irregularly; in some cases it is "regularly" intermittent; it may last indefinitely.

Sometimes the wheals, instead of being flat and but slightly raised, project more boldly, and are of a hemispherical shape, attaining the size of a nut, or even that of a walnut (U. tuberosa).

A large proportion of the cases of chronic Urticaria that occur in hospital practice are dependent on the presence of the pediculus corporis.

Urticaria more commonly affects the shoulders, the loins, the thighs, the face, and the forearms.

Diagnosis.—Urticaria can scarcely be confounded with any other species of eruption. The prominent hard wheals, their evanescent character, and the sensations that accompany them, are in most cases sufficient to distinguish this disease from all others. Urticaria tuberosa may, however, present some resemblance to Erythema nodosum. But the course of the latter is more acute, its progress more continuous, and the development and decline of its individual patches take place more gradually.

Prognosis. — Although always a very annoying and often an obstinate complaint, Urticaria is scarcely ever attended with any danger. Even in severe cases of "U. ab ingestis," when the disease certainly puts on a most alarming appearance, it has scarcely ever been known to lead to a fatal issue; and in those rare cases where it has seemed to be the cause of death, the result is to be attributed rather to the internal disorder produced by the ingested substance than to the effect of the rash.

Treatment. — In "Nettle-fever" rest should be enjoined, the diet should be restricted, and mild aperients and cooling salines should be prescribed. If there be any over-acidity of the stomach, magnesia should be given; and if there be much fever it should be combated by small doses of tartar-emetic. When the eruption appears to result from the indigestion of some noxious article of diet, an emetic should be given as soon as possible, and it should be followed by some efficient purge. If there be much depression, a dose or two of chloric ether will be serviceable. The patient should be put to bed, and restricted for some little time to bland mucilaginous drinks. In either variety of the acute form, it is better to dispense with local applications.

When the disease is chronic, it sometimes happens that there is some offending article in the patient's diet, and that he requires only to abstain from this particular kind of food in order to be quit of his eruption. When this is so, the offending cause varies in different cases, and is not always easy of discovery. Willan proposes that each article of food or drink that the patient has been in the habit of taking, should be successively omitted for a short time from his diet, so that in this way the noxious substance may be detected. In some persons pork will turn out to be the cause of the rash, in some milk, in others eggs, and so forth. In some chronic cases, the internal administration of the mineral acids will be of service, and with this may be advantageously conjoined the use of mineral acid baths. But when the eruption is associated with habitual over-acidity of the stomach, the alkaline carbonates, administered both internally and externally, are indicated.

When the complaint assumes an intermittent type, quinine should be given in tolerably large doses. If the patient be of a plethoric habit, he should be restricted to a bread and milk diet for some time.

In some obstinate cases arsenic is a valuable remedy; vapor baths and the vapor douche are often useful in severe cases of long standing.

Urticarious patches, the result of local irritants, must be dealt with according to the nature of the irritation that has produced them; thus the leaves of the "dock" are the proverbial antidote to the sting of the nettle. The stings of insects (gnats, ants, wasps, &c.) derive their pungency from the injection of a small quantity of formic acid into the puncture made in the skin, and the application of a dilute solution of ammonia or potash relieves the pain of them almost directly.

[Various drugs are capable of producing Urticaria, erythema, &c., under certain circumstances, not to be anticipated except after knowledge of the patient's idiosyncrasies. Heinlein[1] has reported the production of Urticaria by salicylic acid. Köbner[2] asserts the causation of an exanthematous eruption, much like scarlatina,

[1] Memorabilien, Band xxiv. Heft 8, Sept. 30, 1879.]

[2] Berliner Klinische Wochenschrift; cited in Med. Times and Gazette, Nov. 23, 1878.]

by the administration of quinine. Farquharson[1] and others have known quinine to produce eczema. Belladonna, strychnia, chloral, and digitalis are all said to have occasionally acted in a similar manner, probably through their influence upon the vaso-motor centres.—H.]

SECTION II.—SQUAMÆ.

The Squamous, or Scaly eruptions, are, Psoriasis, Pityriasis, and Ichthyosis.

Psoriasis.

Synonyms.—Dartre lichénoïde; Herpes furfurans; Dartre sèche; Dry scaly tetter; Lepra vulgaris; Dartre squammeuse sèche; Schuppenflechte.

Definition.—Psoriasis (ψώρα, a scurvy) may be defined as a disease of the skin, in which large thick white nacreous scales cover and adhere closely to a thickened, creased, tawny-red patch of skin.

Causes.—Psoriasis is a constitutional disease of the skin.

The predisposing causes are a robust and vigorous constitution, adolescence, or adult age, and in some cases hereditary predisposition.

The exciting causes are mental emotions or anxiety; the abuse of alcoholic liquors; the seasons of spring and autumn; local injury or irritation.

It is not a contagious disease.

General Description.—Psoriasis commences in small white spots of the size of a pin's head. If one of these small scaly incrustations be detached by the fingernail, it will be found to be pretty firmly adherent to the surface and to conceal a minute reddened, slightly elevated patch of skin. These spots gradually increase in diameter and form disks, which vary in size from that of a pea to that of a half-crown. At the same time the squamous exudation becomes thicker and more opaque, and exhibits a mother-of-pearl-like or even silvery lustre. At a little distance the skin exhibits the appearance of having been splashed with mortar. If a separated crust of about the size of a shilling be broken across, it may be seen to be of about the thickness of cardboard, and to be made up of thin dry imbricated scales arranged in strata one above the other. The skin disclosed by the removal of the crust is slightly elevated. On pinching it up between the forefinger and thumb it may be felt to be thicker and less supple than the unaffected portions of skin. It is of a tawny-red color. On making pressure on it for a moment with the forefinger, the redness temporarily disappears, leaving however a light yellow stain. Its surface is somewhat creased.

As the spots continue to increase in size, those which are near to one another may coalesce so as to form irregular patches of some extent; these are more frequently found on the upper part of the front of the leg or on the back of the forearm.

Not uncommonly a spot as it spreads at its circumference heals at its centre, so as to form an annular patch of the disease. These rings as they increase in diameter may undergo various changes in form; thus part of the circle may heal, while the rest of it spreads; or, the ring remaining unbroken, some parts of it may extend their distance from the centre more rapidly than others; or two neighboring rings may unite. By such accidents are produced figures of a semicircular, an oval, or a horseshoe form; or the disease may describe figures of 8, or be so fantastically arranged as to give the skin much of the appearance of a geographical map. In some rare instances, by the fortuitous coalescence of several incomplete circles, a serpentine band of some length is produced.

Psoriasis usually makes its appearance first at the elbows and knees, and when it has become spread more extensively it still remains worst at those places. It appears next on the back and afterwards on the chest and belly. It is not uncommon on the hairy scalp, and on the palms of the hands and the soles of the feet; on the face, where it is comparatively rare, it is seen more commonly on the upper part of the forehead and on the eyebrows. Psoriasis is usually attended with more or less itching. It is not unfrequently found associated with eczema.

Duration.—Psoriasis follows an extremely chronic course, and its tendency is to recur again and again after recovery. It may last a few weeks, a few months, a few years, or even the greater part of a lifetime.

Termination.—When the disease is about to disappear the patches gradually get smaller, the scaly incrustations thinner, and the skin beneath them loses its undue thickness and tawny-red color, and regains its elasticity. As a rule, the disease disappears first from the chest and abdomen if it be already present in those situations. Next it deserts the back, and lastly the limbs; traces of it still continuing to linger for some time about the elbows and knees after every vestige of it elsewhere has disappeared.

Diagnosis.—Psoriasis is recognized by the dryness, the thickness, the opacity, the sheen, and the imbricated arrangement of its scales; by the thickened, inelastic, dry, wrinkled condition and tawny-red color of the skin underneath them,

[1] Lancet, Nov. 16, 1878.]

and by the predilection of the disease for the neighborhood of the knees and elbows; it may however be mistaken for Pityriasis, but in this disease there is much less thickening and furrowing of the skin, and the scales are much scantier, thinner, and finer than those of Psoriasis.

Eczema, which in its squamous stage may be thought to bear some resemblance to Psoriasis, may be distinguished by the moist appearance and thinness of its scales, and the readiness with which they may be detached from the skin. Circumscribed or annular patches of Lichen are to be distinguished by the paucity of the scales and their want of opacity and lustre, as well as by the more rugged appearance of the affected skin, from similar patches of Psoriasis.

In squamous Syphilide—the so-called syphilitic Psoriasis—the patches do not attain the size that is commonly reached by those of simple Psoriasis. The scales too are smaller, thinner, scantier, and are confined to the middle of the patch. The tawny-red skin is smooth and shining, in place of being rough and creased; the skin-affection is usually accompanied by other symptoms of secondary syphilis. It should be noticed that a tawny hue of the inflamed skin, which is so commonly relied on as the means of recognizing a syphilitic eruption, is common to syphilitic and non-syphilitic Psoriasis.

Prognosis.—This is always favorable when the disease occurs in a mild form and is submitted to proper treatment. Its liability to reappear after it has been cured must however be kept in mind. When the patient is advanced in life and the disease is of long standing and extensively spread, it may resist treatment for several years.

Varieties.—When the spots of Psoriasis barely exceed the size of a pin's-head, the disease is called *P. punctata;* when they have attained the size of a split-pea or a threepenny-piece, it is called *P. guttata;* and when the rounded patches range in diameter from that of a sixpenny-piece to that of half-a-crown, the term *P. nummularis* is employed. Where the disease presents itself in extensive irregular patches, the epithet *diffusa* is applied to it. When it occurs in rings or exhibits the traces of an annular arrangement, it is distinguished by the term *P. circinata.* If its mode of disposition should chance to produce a serpentine band, it is said to be an example of *P. gyrata.* *P. inveterata* is a term applied to the disease as it is sometimes met with in persons who have had numerous and severe attacks of it; when the greater part of the surface is covered with a thick, scaly incrustation, and the thickened inelastic skin is chapped or even deeply fissured opposite the joints, *P. palmaris et plantaris.* Psoriasis when it affects the palms and soles is characterized by larger, thicker, and less lustrous scales than it produces in other situations, and by deep painful fissures in the skin, which exude a serous or sanguineous fluid.

P. unguium.—When the nails are affected they become thickened, opaque, sometimes grayish in color, deeply grooved often, and not unfrequently pitted in a peculiar manner; they may become more or less laminated, and in some cases the nail gets replaced by a scaly incrustation. Psoriasis when it affects the face (*P. facici*), which, however, is not a common situation for it, assumes much of the appearance of inflamed circumscribed Pityriasis, the scales being small and thin, and only scantily concealing the tawny-red patches of skin to which they adhere. Psoriasis of the hairy scalp (*P. capitis*), is peculiar in this respect, that while Pityriasis, an apparently much less serious disease, is frequently accompanied with considerable thinning of the hair, Psoriasis, the crusts of which are often of some thickness in this region, entails no loss of hair.

Therapeutics.—If the eruption be acute, that is to say if it be both recent and extensive, and the patches much inflamed, refrigerant medicines and emollient applications should be employed, and at the same time the diet should be restricted. When the inflammatory appearance of the disease has by such means been reduced, recourse should be had to the liquor arsenicalis (Ph. Br.) in doses of from ℥ ij to ℥ v thrice daily. In cases where the inflammatory excitement of the patches has a tendency to reappear, it will be advisable to make the addition of a small dose of the potassio-tartrate of antimony, or to replace the liquor arsenicalis by Donovan's solution. Free phosphorus in doses of $\frac{1}{10}$ grain (t.d.s.) dissolved in oil is sometimes a most efficacious remedy. In some cases, however, these remedies are inadmissible on account of their giving rise to gastro-intestinal inflammation, and the same objection applies to another remedy of almost equal repute—the tincture of cantharides, which has the additional disadvantage of causing irritation of the genito-urinary tract. Under such circumstances it is necessary to rely chiefly on external applications. Ointments of the green iodide or the ammonio-chloride of mercury, of the former in the proportion of from ten to thirty grains to the ounce, of the latter in the ratio of from a scruple to a drachm to the ounce, are certainly of great efficacy in the treatment of Psoriasis; but when, as is often the case, the disease occupies a large extent of surface, their use is very apt to occasion salivation. The various tarry preparations have a great and well-merited

reputation as topical applications in Psoriasis. The unguentum picis liquidæ (Ph. Br.) diluted with twice the quantity, or with an equal proportion of lard, or applied *per se*, or ointments of the huile de Cade, or of the empyreumatic oil of the Betula alba in the same proportions, or ointments of creasote or of resin, may be employed; they are open, however, to one therapeutical objection, and that is, that in some persons they are apt to give rise to an erysipelatous inflammation of the skin, which has anything but a favorable influence on the progress of the disease. This is to be guarded against by the prudent use of a weak ointment to commence with, but the pungent smell of these substances, and the fact that they stain and corrode the linen of the patient, are further drawbacks. In the matter of smell the oil of the Betula alba is perhaps the least objectionable, and creasote has the advantage of not staining the linen.

Chrysophanic acid (derived from Goa-powder[1]) in the form of ointment (ʒss to ℥j) has recently been used with considerable success, but it is apt to produce conjunctivitis unless care be taken in its use; waterproof (vulcanized india-rubber) underclothing in some cases of itself effects a cure. Prolonged immersion, namely, for several hours daily, in a simple tepid bath at the temperature of 92° Fahr. will in some instances cure the disease.

[The addition of flaxseed infusion and bicarbonate of sodium to the tepid bath will contribute to this result, by adding to the emollient effect of the bath. A lotion of the sulphite of sodium is sometimes very useful in Psoriasis. Several practitioners prefer a weaker preparation of chrysophanic acid than that above mentioned, viz., not more than five or ten grains to the ounce. Cottle[2] advises an unguent made with from five to ten grains of chrosophanic acid in an ounce of vaseline or ozokerin.

Pyrogallic acid (first proposed for this use by Jarisch) has been employed by Hebra[3] and others instead of chrysophanic acid; having the advantage of being less irritating, and not staining the skin.[4] A ten per cent. solution of pyrogallic acid has been found to be efficacious in Psoriasis. It has also been used in the form of an unguent.

Neisser,[1] however, reports a case occurring in the dermatological clinic at Breslau, in which death resulted, in a robust man, from the application of a ten per cent. salve of pyrogallic acid over half of the body, in treatment of Psoriasis. Neisser recommends, therefore (the poisonous action of pyrogallic acid being also proven by experiments upon animals), that its use be carefully limited to a small portion of the surface of the body at once.—H.]

Pityriasis.

Synonyms.—Porrigo furfurans; Dartre furfuracée volante; Teigne amiantacée; Dartre farineuse; Dandriff; Kleinenflechte; Herpes furfurans.

Definition.—Pityriasis (πίτυρον, bran) is a disease in which loosely-adherent minute, thin, opaque, white scales cover a harsh surface of skin.

Causes.—Pityriasis is a constitutional disease which is often transmitted hereditarily. It occurs on the scalp, more commonly in females than in males, and in persons who wear their hair long than in those who keep it cut short. Children from the age of six to that of puberty are especially liable to it. It affects the dark rather than the fair.

The immediate causes to which it has been traced are a previous eczema of the same portion of skin, over-feeding, great fatigue, and mental anxiety.

General Description.—The commencement of the disease is a dry, harsh condition of the skin which loses its natural softness and suppleness. Soon very dry, minute, thin, opaque white scales make their appearance on it; they are readily detached even by the slightest friction, or even fall spontaneously, but are renewed as fast as they fall off. Sometimes the skin is reddened as well as harsh, and may even be slightly thickened and creased so as to approach the condition already described as proper to Psoriasis. There is usually more or less itching of the affected skin, but unless the surface involved be extensive and considerably inflamed there is no constitutional disturbance.

The *varieties* of Pityriasis are P. alba, P. fusca, P. rubra, and P. pilaris.

Pityriasis alba attacks the scalp and (less commonly) the hairy parts of the face, and is characterized usually by an *abundant* furfuraceous desquamation; although there is generally no redness, there is always considerable itching of the affected skin. The scales are readily detached in great numbers by scratching or rubbing the part; they are thin, dry, opaque, and

[1 Also from the common wall-lichen, and from the roots of rhubarb and sorrel (rumex). —H.]

[2 St. George's Hospital Reports, 1877–78.]

[3 Berliner Klin. Wochenschrift, Nov. 24, 1879.]

[4 The coloration of the skin produced by chrysophanic acid may be removed by washing repeatedly with a dilute solution of potassa.—H.]

[1 Berliner Klin. Wochenschrift, Nov. 24, 1879.]

white. This affection does not necessarily entail baldness, nor does the hair in any instance fall spontaneously, but in many cases it becomes extremely dry and brittle, so that if at all long it comes off in great quantities when combed. The baldness so produced is only temporary; when the disease ceases the hair grows again as thickly as before.

P. fusca occurs on the face and neck in the form of rounded patches, which vary in size from that of a fourpenny-piece to that of a crown. The skin, which is a little thickened and slightly creased, is of a faint tawny-red color, and is sprinkled over with minute, white, loosely-adherent farinaceous scales, which are neither so large nor so opaque as those of P. alba. This variety occasions scarcely any itching, but when irritated the patches are liable to much smarting and burning. These sensations are generally provoked by sitting before the fire, by facing a cold wind, or by washing the face with soap and water.

P. rubra is a less common variety than either of the preceding. It is sometimes accompanied with slight febrile disturbance. The scales are larger and more adherent than in P. fusca, and the skin is much reddened. The disease is situated generally on the chest, but is sometimes extensively spread over the upper part of the body and the upper limbs. It is accompanied by itching and tingling.

P. pilaris is the rarest variety of all; it affects only the orifices of the hair-follicles, leaving the intervening skin untouched. It may invade every region except the scalp. The orifices of the hair-follicles, more particularly of those situated on the outer surfaces of the limbs, become thickened and prominent, and the root of each hair gets surrounded by a small, hard, conical elevation, composed of minute adherent scales; the skin feels dry, harsh, and rough, and presents the appearance commonly known under the name of goose-skin. There is rarely either redness, itching, or tingling of the diseased surface. Pityriasis pilaris is an extremely chronic and obstinate affection. It is generally associated with P. rubra of the chest and arms.

Duration.—Pityriasis generally follows a chronic course, lasting for several months, or even many years. In children, however, its duration is often limited to a few weeks.

Diagnosis.—Pityriasis is to be distinguished from *Psoriasis* by the scales in the former disease being small, thin, bran-like, and but loosely adherent to the skin; while in the latter they are large, thick, adherent, and nacreous. The considerable infiltration and thickening of the cutis in Psoriasis, and the predilection of that disease for the knees and elbows, are further means of diagnosis. A *squamous eczema* may in many respects resemble Pityriasis, but the moist character of the former, as well as the greater size, the yellowness, and the semi-translucency of its scales, will readily distinguish it. *Herpes circinatus* is a disease with which P. fusca is very apt to be confounded; but the more perfectly circular shape of the patches of Herpes, and their well-defined edges, which are more elevated and scaly than their central portions, or a microscopical examination of the scales, will generally suffice for its recognition. *Ichthyosis* may easily be known from Pityriasis by its history alone, since it is always a congenital disease.

The *Prognosis*, except in the case of P. pilaris, is always favorable; but all varieties of the disease are apt to return after recovery.

Therapeutics.—In Pityriasis of the scalp or of the hairy parts of the face, the first thing to be done is to have the hair cut short. If the whiskers or beard be affected, they should be trimmed close with scissors, not shaved with a razor. In any case where the scalp is affected, and hair-cutting objected to, all combing of the hair, and any mode of dressing it which pulls it much about, should be interdicted.

The Pityriasis of the scalp which occurs in infants, and in which there is considerable admixture of sebaceous matter with the scales, merely requires that the head should be kept well cleansed, brushed often and lightly with a soft brush, which, acting as a gentle stimulus to the skin, soon restores it to its normal condition.

The local applications most in use for Pityriasis are the vapor-douche, alkaline-baths, sulphuretted-baths, alkaline-lotions (sodæ subcarb. gr. v. to ℥j), a solution of soft-soap, lotions of nitric acid (♏xx to ℥j), of acetic acid, of hepar sulphuris; ointments of alum, of acetate of lead, of sulphate of zinc, of ammonio-chloride of mercury, of tar, of nitric acid (♏xx to ℥j).

The internal remedies are the various sulphuretted mineral waters, the liquor arsenicalis, bitters—hops, centaury, chiretta, gentian—sulphur.

The diet should be of the simplest kind.

ICHTHYOSIS.

Synonyms.—Ichthyose; Fish-skin disease; Die Fischschuppenkrankheit; Lepra ichthyosis; Der Fischschuppenaussatz; Maladie écailleuse; Serpentine; Pargamine.

Definition.—Ichthyosis (*ἰχθυς*, a fish) is a peculiar congenital condition of the

skin, in which the epidermis, in place of being smooth, unctuous, soft, and elastic, is dry, harsh, rough, and unyielding. This condition is a permanent one.

Causes.—The disease is congenital, and is in many cases hereditary, sometimes missing a generation. It has been observed by Cazenave to be commoner in certain districts of France than in others, and by Biett that females are less liable to it than males.

General Description.—Ichthyosis occurs as a peculiar scaly condition of the skin, in which there is neither redness of the cutis nor any sensation either of heat, itching, or tingling. The scales are pretty firmly adherent to the surface on which they rest, and are not readily detached. If pulled off, their separation does not occasion any pain, and the surface disclosed is neither rough, as in Psoriasis, nor moist, as in Eczema. In many cases the formation of scales is complicated with an excessive development of pigment. The disease is sometimes general, sometimes local. When general, the palms of the hands, the soles of the feet, the armpits, the groins, and the eyelids are always left unaffected. When partial, it affects especially the limbs, more particularly the neighborhood of the knees and elbows.

On different parts of the same individual it sometimes presents widely different appearances. Whatever may be its intensity, or for however long a period it may have existed, it exercises no perceptible influence on the general health. Although it never entirely ceases, it is sometimes greatly modified under the influence of the seasons; it is generally less in summer than in winter. This is doubtless due to the larger quantity of liquid secreted by the skin in warm weather.

The *varieties* are I. serpentina, I. nitida, and I. cornea.

I. serpentina is so called from the skin in this variety resembling in appearance the belly of a lizard or of a snake. The epidermis is dry and glossy, and is divided into little angular pieces by a number of fissures, which decussate with one another.

In *I. nitida* the skin is much like that of a fish. The scales have a mother-of-pearl-like glitter. They are larger than in the preceding variety, and thicker; they have an imbricated arrangement. Sometimes the scales, instead of being pearly-white, are of a dark-gray color.

In *I. cornea* the epidermis is much hardened, greatly thickened, and deeply fissured, so as to form a series of closely-packed, horny, mobile excrescences, which are usually of a dark olive-brown color. These are sometimes so long and so hard, that by passing the finger-tip rapidly over the surface, a dry rattling sound may be produced. Persons affected with this variety of Ichthyosis sometimes exhibit themselves as a public show, under the name of porcupine-men.

Diagnosis.—The only two diseases with which Ichthyosis is likely to be confounded are *Psoriasis* and *Pityriasis*. From the former, however, it differs in being usually extended over a large surface—sometimes over nearly the whole of the body; while Psoriasis occurs in the form of patches, which are separated from one another by intervals of sound skin. Again, when a portion of skin is affected with Ichthyosis, there is no definite limit to the disease; it fades by insensible gradations into sound skin. The scurf of Pityriasis in its fineness, but more especially in the slightness of its adherence to the skin, differs widely enough from the scales of Ichthyosis. Again, the absence of all inflammation of the skin and of the itching and other unpleasant sensations that attend it serve to distinguish Ichthyosis from either of the two other squamous diseases.

Therapeutics.—Although the treatment of Ichthyosis cannot, at least in the present state of our knowledge, be radically curative, still much may be done in the way of palliative treatment. For the serpentine and nacreous varieties the most efficacious remedies are in the first instance baths, lotions, or ointments of the alkaline carbonates; and when by such means the skin has been temporarily restored to a healthy condition, this may often be maintained by keeping the surface slightly greased with almond- or olive-oil, which should be washed off at least twice a week. Cod-liver-oil has, on theoretical grounds, been recommended in place of sweet-oil, but no real advantage is to be obtained by the substitution, and the nauseous smell of the fish-oil is much against it. Vapor-baths, vapor-douches, or warm-water douches may take the place of alkaline applications, and glycerine may be used instead of oil. The administration of cod-liver-oil or of arsenic internally, or of tar both internally and externally, has been advocated, but the efficacy of these remedies is very doubtful. In the horny variety the treatment should be commenced by painting limited portions of the surface in succession with blistering-fluid. When by this means the horny excrescences have been removed, the skin should be treated as in the other varieties.

SECTION III.—PAPULÆ.

The Papular eruptions are, Lichen, Strophulus, and Prurigo.

LICHEN.

Synonyms.—Dry itch; Dartre furfuracée volante, Poussée; Gale sèche; Schwind-

flechte ; Papulæ ; Herpes siccus ; Tinea volatica ; Papulæ siccæ ; Exormia lichen ; Scabies sicca ; Licheniasis adultorum ; Scabies agria.

Definition.—Lichen (λειχήν, a tree-moss[1]) is an eruption of numerous minute red papules clustered together, attended with much itching, and succeeded by a harsh, wrinkled, thickened condition of the skin.

Causes.—Lichen is met with at all ages, but affects preferably adults. It is commoner with females than males, and in spring and autumn than in summer or winter. Persons of nervous temperament are especially liable to it. It is sometimes hereditary. Certain occupations may be looked upon as predisposing causes, viz., those which subject any part of the skin to the constant action of irritants—*e. g.*, that of a pastrycook, a grocer, a bricklayer, a metal-worker, or a dyer ; and those which entail frequent exposure to the glare of a furnace—*e. g.*, that of a cook, a smith, a metal-founder, or a stoker. Overfeeding, drunkenness, too rich a diet, a sudden chill, watchfulness, and depressing mental emotions, such as anxiety, or grief, are also to be ranked among the causes of Lichen.

Description.—The disease at its commencement consists of an eruption of minute red papules clustered together on an inflamed portion of skin. On opening one of these papules with the point of a needle it is found to be solid, containing neither serum nor pus. On passing the finger over the affected skin, it is felt to be dry and rough. After a short time the tops of the papules either become covered with white, branny scales ; or, getting excoriated by repeated scratching, they exude minute drops of serum or blood, which dry up speedily into small, hard, gray, or black crusts. At the same time the skin becomes thickened, its natural linear markings or wrinkles get deepened, and it loses its elasticity ; so that if the affected part be in a position where it is constantly liable to be stretched, it "parts" opposite one or more of these furrows, which thus become converted into cracks or even deep fissures. This is a common result when the disease occupies the back of the wrist. The increased thickness of the diseased skin may be readily felt if a portion of it be pinched up between the finger and thumb. If the direction of the little furrows be examined, it will be found that they are arranged so as to cut the surface of the skin into minute fusiform islets.

The *varieties* of Lichen are L. simplex, L. circumscriptus, L. agrius, and L. inveteratus.

The term *simplex* is applied to the disease when it presents the characters above described in a comparatively mild degree, is diffused over a surface of some little extent, and has no definite outline ; *circumscriptus*, when it occurs in rounded patches (of the average size of a five-shilling-piece), with well-defined outlines ; *agrius*, when the eruption is acute, is ushered in with febrile symptoms, and partakes in some degree of the character of Eczema or of Impetigo ; that is to say, there is an admixture of vesicles or of pustules with the papules ; *inveteratus*, when the disease has become very chronic and severe. This variety is characterized by considerable thickening of the skin and unusual depth of the furrows on its surface. In some cases of L. inveteratus the scales that are formed on the diseased surface are so copious and so thick, as to give the disease much of the appearance of Psoriasis. Other terms have been applied to Lichen : *lividus*, when occurring in cachectic individuals the papules are livid ; *gyratus*, when the disease forms sinuous bands ; *tropicus*, which distinguishes a variety resembling L. simplex that is common in tropical climates.

What has been termed *L. urticatus* is a variety of Urticaria. "*L. pilaris*," again, is a form of Pityriasis.

The itching and burning sensations that accompany Lichen are usually severe, but they are especially so in cases of L. inveteratus. They always become aggravated towards the evening. The disease occurs most commonly in persons of nervous or sanguine temperament ; it is confined to no special period of life ; it affects chiefly the backs of the hands and wrists, the back and sides of the neck, the front of the thighs, and the back of the trunk ; it is least frequently seen on the hairy scalp. It is a constitutional disease ; follows a chronic far more commonly than an acute course, and is apt to recur again and again after apparently perfect recovery. It is not contagious.

Diagnosis.—L. simplex may be mistaken for Prurigo, Scabies, or Strophulus ; L. agrius for Eczema ; and L. circumscriptus for Herpes circinatus, Pityriasis, or Psoriasis : but

In *Prurigo* the papules are large, flat, isolated, and most of them are covered with a small black crust.

In *Scabies* the situation of the eruption, its multiform character, and the presence of the acarian furrows are distinctive signs.

Strophulus affects only young children.

[1] This is the derivation usually given. More correctly, however, the primitive meaning of λειχήν is a skin-disease, and it is derived from λείχω to lick (as animals lick a sore), so that the skin-disease was not viewed as a moss on the skin, but rather the tree-moss was regarded as a skin-disease of the tree.

It is always an ephemeral eruption. The papules are larger than in Lichen, and are usually scattered loosely over the surface. When grouped, the papules in each group are few in number, and the patches are small. There is no induration or furrowing of the skin in Strophulus.

Eczema may be distinguished by its appearing at first in the shape of vesicles instead of papules; subsequently by the even surface, superficial excoriations, abundant plastic serous secretion, broad, moist, yellow, flaky incrustations, and thinner state of the skin, which contrast with the roughened, dry, papulated surface, the small, dry, gray crusts and thickened cutis of Lichen.

Herpes circinatus may be known by its shape being more circular than that of L. circumscriptus, its scales thinner and softer, and its centre less rugous; moreover, it spreads with much greater rapidity. In doubtful cases a microscopical examination of the scales may be had recourse to.

Pityriasis, when it occurs in reddened, circumscribed patches, with slight thickening and wrinkling of the skin, may resemble L. circumscriptus, but there is generally but little if any itching in this form of Pityriasis. The induration and thickening of the skin is much less marked, and the scales are much more readily detached than in Lichen.

In *Psoriasis* the skin is considerably thickened and wrinkled, but not to the extent seen in L. circumscriptus. The scales, on the other hand, are much thicker and more copious, and exhibit a special silvery lustre; the disease moreover affects especially the elbows and knees.

Prognosis.—Lichen is not in any way dangerous to life; but its obstinate character, its tendency to relapse after recovery, and the severe itching that accompanies it, render it a serious affection.

Treatment.—In an ordinary acute attack of Lichen but little treatment is required. A moderate and unstimulating diet, the avoidance of alcoholic liquids, and the wearing of soft underclothing, are sometimes all that is necessary. If feverishness attend the complaint, saline laxatives and refrigerant drinks may be given; and if the affected skin be very irritable, emollient tepid baths, containing bran, starch, or gelatine, or lotions of infusion of linseed, of solution of acetate of ammonia, of lime-water, of diluted vinegar, of mist. amygd. amar., or of *weak* hydrocyanic-acid solution may be used. In a severe attack of L. agrius it may be necessary to enjoin a very restricted diet, to apply leeches in the neighborhood of the inflamed surface, and to employ starch- or bread-poultices. In a less severe attack, excluding the surface from the air by means of the blandest applications, such as sweet almond-oil, cold cream, glycerine; or by dusting it over with lycopodium may at the outset suffice for local treatment. If, when the inflammation has decreased, the disease exhibits a tendency to assume a chronic condition, much benefit is often to be derived from the use of alkaline baths, which may contain an ounce of the carbonate of potash or of soda to the gallon of water. In some cases baths of sulphuret of potassium may be substituted with advantage. These measures should be conjoined with the internal administration of the fixed alkalies or their carbonates.

In obstinate cases of Lichen, where the skin has become much thickened and is desquamating, lotions of liq. potassæ, ʒss–ʒss to ℥j aq. (the stronger solutions requiring great caution in their use), sulphur vapor-baths, the vapor-douche, ointments of calomel, camphor, tannin, the green iodide of mercury, the bichloride of mercury or tar, are proper applications. Internally small doses of Donovan's solution or of some one of the sulphurous mineral waters should be given. Cases of chronic Lichen that are attended with debility, as in L. lividus, are greatly benefited by such tonics as the nitro-muriatic acid or the triple citrate of quinine, iron, and strychnia. Cauterization with nitrate of silver is useful in some cases of persistent L. circumscriptus, and in similar cases the use of chrysophanic acid ointment (gr. x–ʒij to the oz.) has proved serviceable. In some cases the wearing of waterproof underclothing over the patch or patches is of considerable benefit. Free phosphorus taken internally (dissolved in oil) in doses of gr. $\frac{1}{60}$ t. d. s. proves in some instances a very efficacious remedy.

Strophulus.

Synonyms.—Red Gum; Tooth Rash; Feu des dents; Lichen Strophulus; Exanthema Strophulus; Rothe.

Definition.—Strophulus (στρέφω, to torment) is an acute eruption, accompanied with itching, which appears in the form of slightly acuminated papules of the size of a pin's head or that of a millet-seed, distinct from one another, and either whiter or redder than the surrounding skin.

Causes.—The disease is peculiar to infancy and childhood; it is of most frequent occurrence in the first two years of life. This is doubtless owing to the vascularity of the skin of infants, and the excitability in them of the nervous centres concerned in reflex action. The immediate causes of Strophulus are errors of diet in the mother or wet-nurse while suckling, or the more direct administration of unsuitable food, over-clothing,

rough flannel next the skin, uncleanliness, confinement to close and heated apartments, and, most of all, the constitutional disturbance produced by the eruption of the first set of teeth.

Description.—The *varieties* of Strophulus are S. intertinctus, S. confertus, S. volaticus, S. candidus, and S. albidus.

S. intertinctus is characterized by papulæ of a vivid red color, sprinkled scantily over the surface, distinct from one another, often intermingled with erythematous spots or patches. In *S. confertus* the papulæ are smaller and are less red than those of the preceding variety, but are more numerous, and are often clustered together. *S. volaticus* appears as small red rounded patches, each of which is made up of a few papules, closely grouped together. These patches last only for a day or two, and disappear at one spot to reappear at another. In *S. candidus* the papules are large and distinct; they have a smooth and shining surface, and are lighter colored than the surrounding skin. They are not, however, surrounded at their base by any inflammatory areola.

The above varieties of Strophulus are attended with slight feverishness, and, when dependent either on visceral derangement or dentition, with the symptoms peculiar to those causes respectively. The average duration of the eruption is about a week, but it occasionally lasts for as long as three weeks. When it disappears it is succeeded by a slight ephemeral furfuraceous desquamation.

Strophulus affects chiefly the exposed parts of the surface, the face, forearms, and backs of the hands, but occurs commonly on other parts of the body.

S. albidus was classed under the genus Strophulus, on account of its possessing what were thought to be the essential characters of that affection, namely, that it consists of small discrete papules, and is an infantile disease. However, in more important details it differs widely from the other species of Strophulus. Thus it is a chronic and indolent affection, produces no itching, and is in no way connected either with gastro-intestinal disorder, or with the process of teething. Again, the substance of the papules instead of being made up of infiltrated fibrocellular tissue, consists of a collection of inspissated sebaceous follicles. They occur principally on the face, and appear as small opaque, white, elevated specks, which may or may not be surrounded by a slight erythematous ring. They are readily distinguished from S. candidus by the characters already mentioned, by their much smaller size, and by their *opaque* white appearance. They often coincide with the other varieties of Strophulus, although, as above stated, they are due to a separate cause. They result from the activity of the sebaceous function of the skin in the infant.

Diagnosis.—The diseases for which Strophulus is most likely to be mistaken are Scabies, Lichen, and Urticaria, but in infants the eruption of *Scabies* on the hands and feet is usually vesicular, and the acarian furrows are readily found; the eruption generally appears first on the nates; the history of contagion is readily made out, and the nurse is almost invariably affected. In *Lichen* the papules are small and clustered together, and in young children the eruption is generally widely spread, so that a large continuous surface becomes harsh, rough, and inflamed. In *Urticaria* the papules are larger and flatter, and are mingled with still larger irregularly-shaped pomphi. They are very ephemeral, disappearing suddenly at one place and reappearing as suddenly at another. This latter character, it is true, is shared also by S. volaticus, which approaches nearly in nature to Urticaria; but the diagnosis between the two is of but little practical moment, since they are both benefited by the same measures, and are of similar origin and nature.

Prognosis.—Strophulus is a trivial affection, which rarely lasts longer than a week or two, and is not prone to recur.

Treatment.—Tepid glycerine-baths, or sponging with tepid milk-and-water, and powdering the skin with starch or lycopodium, are generally all that is necessary. If the child is suckling, its nurse should take some saline refrigerant drink. If the gums are swollen and inflamed at any part they should be lanced. When the eruption is connected, as it often is, with acidity of the stomach, this should be corrected by some one of the alkaline carbonates—carbonate of magnesia, of soda, or of lime being selected, according to the state of the bowels, aided, if need be, by some carminative. The room should be kept cool, and the infant's clothing should be light and soft.

Prurigo.

Synonyms.—Pruritus; Cresmos; Prurit; Psore papuleuse; Scabies papuliformis.

Definition.—Prurigo (Prurigo an itch) is a disease characterized by an eruption of comparatively large, but only slightly elevated flat papules of the same color as the surrounding skin, distinct from one another, covered at their tops by small black crusts, and accompanied by more or less intense itching. It is in some instances contagious.

Causes (of general Prurigo).—The pediculus corporis, poverty, dissipation, neglect of cleanliness, drunkenness, old age, exhausting chronic diseases. [The acarus scabiei also produces a species of general

Prurigo. This is treated of under the head of Scabies q. v.] (Of Prurigo pubis)—The pediculus pubis. (Of Prurigo podicis and scroti)—A sedentary life, a too rich and stimulating diet, habitual constipation, ascarides in the rectum, a chronically-congested condition of the rectum, internal piles, urinary calculi, old age. (Of Prurigo pudendi muliebris)—Leucorrhœa, uterine disease, the "change of life," ascarides in the rectum, a feeble constitution.

Description.—Prurigo may be widely diffused over a large extent of surface, or it may be confined to a very limited area. When of *the diffused kind* it commences by itching of some region which at once provokes the patient to scratch. Soon an eruption of small, scattered, flat papules arises; the tops of these being caught by the patient's nails, are soon scratched off; a slight extravasation of blood ensues, which, coagulating, forms the small black crusts which cap the papules. The itching, which is increased towards the evening, but is always easily supportable, becomes gradually extended over a greater area. In this condition the disease is called *P. mitis.*

In a severer form (*P. formicans*) the irritation is more intense, and is of a different character. The itching is accompanied by pricking and burning sensations, and a feeling as if a multitude of ants were crawling over the skin. It gradually increases in severity and extent, so as to be almost insupportable. The patient is irresistibly impelled to scratch, and seeks relief by tearing the skin deeply with his nails. The irritation is always most severe in the evening and the early part of the night, which is generally far advanced before the sufferer gets any rest. He may even be altogether deprived of sleep for several nights in succession. It is augmented too by the ingestion of a full meal, or of any spirituous drink, or by the warmth of a fire, and I have noticed that it is always much worse in summer than in winter. In this variety the papules are broader and flatter, and are surmounted by thicker and blacker crusts than in P. mitis. They are moreover intermingled with deep, linear excoriations, sealed by streaks of black coagulum, which are the marks left by the patient's nails.

In a variety yet more severe (*P. senilis*), which is found chiefly in old persons, the itching gets gradually more and more distressing, the papular eruption becomes more extensively spread, and the marks of the patient's nails deeper. The skin becomes at some points blackened and rugous, at others dark-colored. The papular eruption gets intermingled in some places with ecthymatous pustules, in others with urticarious wheals and fugacious erythematous patches. The worry of mind and the loss of sleep entailed by this frightful disorder seldom fail to impair in some measure the general health. A patient who has suffered long from the complaint generally wears a haggard and anxious face. In some instances the prolonged and constant torment has led the sufferer to commit suicide.

General Prurigo is seen at all ages. In children and young persons it assumes usually the form of P. mitis, in middle-aged adults that of P. formicans, and in the aged the condition known as P. senilis. As regards its situation, the regions chiefly affected by it are—according to my own researches—either the back of the neck and of the shoulders, together with the upper portion of the front of the chest, or the small of the back, together with the nates and anterior and outer surfaces of the thighs. It may be very severe in either of these two situations, without being very marked in the other. I have seen it occupying all parts of the body, except the hairy scalp, the face, the armpits, the fingers, the palms of the hands, and the soles of the feet. The disease is very chronic, lasting for months or years, and is often extremely intractable. In many cases it appears to be caused and maintained solely by the presence of the body-louse (Pediculus corporis).

A form of Prurigo (*P. pubis*) which holds a middle place between the diffused and the circumscribed kinds is that occasioned by the pediculus pubis or crab-louse. This commences over the pubic region and gradually extends itself upwards over the abdomen and downwards over the thighs. This affection is usually confined to the hairy parts of the anterior surface of the trunk and thighs, and rarely extends downwards below the middle of the legs or upwards above the axillæ. The itching occasioned by it is usually pretty severe, but the eruption consists only of scattered papules smaller in size than those of the varieties already described, and surmounted by redder crusts and of small papular urticarious pomphi. There are none of the deep linear excoriations which form so prominent a feature in P. formicans and P. senilis. It, in fact, resembles papular scabies more than any other disease.

The more important of the circumscribed *varieties* of Prurigo are P. podicis, P. scroti, and P. pudendi muliebris.

P. podicis, or itching of the skin around the anus, is often a most tormenting and intractable affection. The irritation, which is very intense, is constant, but is augmented in the evening and early part of the night. In some cases there is considerable itching of the margin of the anus itself, as well as of the skin in its vicinity. The furious scratching that this complaint provokes generally pro-

duces a sero-mucous discharge from the anus, which is attended with some relief. When the affection has lasted for some time, the skin becomes considerably thickened as well as harsh and inflamed, so as to resemble in some measure chronic Lichen, and the itching gets complicated with severe burning and pricking sensations.

In *P. scroti* there is intense irritation of the scrotum, generally of its posterior surface, accompanied often at first by a sero-sudorific discharge, and later by induration, reddening, dryness, and harshness of the affected skin. This variety often coincides with, and is sometimes merely an extension of P. podicis.

In *P. pudendi muliebris* the parts affected are the labia majora and minora, and sometimes also the lower part of the vagina. The irritation is if possible more severe and more intractable than in either of the two preceding varieties. The impulse to scratch the itching part is so urgent and so frequent as to drive the patient from society, and in some instances to give rise to nymphomania. The appearance of the parts in some cases remains unaltered; in others there is some fulness and redness of the mucous surface, and occasionally minute abrasions, which exude a serous fluid, may be seen.

Diagnosis.—In general Prurigo the large, flat, slightly elevated, isolated papules, of the same color as the surrounding skin, covered with small black crusts of dried blood, are sufficiently distinctive to prevent confusion with any other disease.

In *Lichen* the papules are very small and acuminated, grouped closely together, of a red color, and covered with little gray crusts or with a furfuraceous desquamation.

In *Scabies* the different general arrangement of the eruption, its multiform character, and the presence of the acarian furrows, will serve to distinguish it from Prurigo, but the most ready way of distinguishing practically between the two (one that the author believes he is the first to point out) is that while in Scabies the fingers are always more or less affected, in Prurigo, although the backs of the hands may occasionally be attacked, the fingers *never* are.

Strophulus is a disease peculiar to children; the papules are either much redder or much whiter than the surrounding skin; they are never surmounted by black crusts.

Prognosis.—Under proper treatment Prurigo sometimes disappears in two or three weeks, but it is often extremely chronic, lasting for months or even years. Although not in itself directly fatal, it may lead indirectly to a fatal issue. The constant mental and bodily distress occasioned by it is apt to break down the health, produce considerable emaciation, and render the subject of it more liable to be cut off by other diseases; and the despairing condition of mind sometimes induced by the long-continued, tormenting sensations, may even lead to suicide.

Treatment.—This will vary greatly according to the cause. In *general Prurigo* an over-excitable condition of the skin may be calmed by lotions of alum, acetate of lead, corrosive sublimate, chloroform, ether, or hydrocyanic acid; by ointments of belladonna or opium; by dusting the surface with oxide of zinc; by baths of lime-water, carbonate of soda, dilute nitric-acid, vinegar, alum, or of corrosive sublimate; by the use of tar-ointment; by the employment of soft-soap, or by prolonged daily immersion in tepid-baths; and by the internal administration of opium, belladonna, stramonium, or aconite in suitable doses. When the disease is associated with pediculi, a cerate made with the fixed oil of stavesacre-seeds, as first proposed by the author, or an ointment of the flowers of the Pyrethrum album, of precipitated sulphur, of the sulphate or sulphuret of mercury, of iodide of potassium, or of bichloride of mercury, the use of sulphuretted-water or vapor-baths, or of cinnabar vapor-baths, or the Harrogate or Moffat waters are the most efficient remedies. Scrupulous attention should be paid to cleanliness, and the patient's underclothes frequently changed. When the general health is much impaired, attention should be paid to the diet, which should be nourishing but unstimulating; bitter tonics, steel, cod-liver oil, &c., should be administered; the patient should use tepid sea-salt baths, and take regular exercise in the open air. There are various empirical modes of treatment which have found favor with some. These are the internal administration of nitrate of silver, of arsenic, of sarsaparilla, of the decoction of dulcamara, of the alkaline carbonates, of the iodide of potassium, &c. The author's experience of these, however, is not such as to give him faith in their efficacy.

In *P. pubis* a lotion of hyd. bichlor. gr. ij, ad ℥ aq., or an ointment of hyd. am. chlor., or dusting the surface lightly with calomel, at once cures the disease. The first effect of either of these applications is that the moribund pediculi cause more irritation even than before, but in the course of two or three hours the irritation ceases altogether.

In *P. podicis* it will sometimes be advisable to apply leeches round the margin of the anus; cold hip-baths, cold lotions, anodyne lotions, are generally of service. An ointment of acetate of morphia, made with cold-cream, or a suppository of tan-

nin and morphia made with cacao-butter, will often afford great relief. Citrine-ointment is also a useful application. Internally the most efficient remedies are occasional small doses of calomel, the nitro-muriatic acid, podophyllin, sal ammoniac, the extract of taraxacum. A mixture of mag. sulph. with acid. sulph. dil. in infusion of roses taken thrice daily is sometimes of value. It is of great importance in this affection to regulate the diet, both as regards its quantity, which should be restricted, and its quality, which should be unstimulating.

In *P. scroti* the same plan of treatment should be pursued as in P. podicis.

In *P. pudendi muliebris* any uterine disease or irregularity should be inquired into and treated. The most efficient local applications are a dilute solution of corrosive sublimate, a lotion of calomel and lime-water, or a solution of chlorate of potash. Internally various anodynes and nervine tonics may be given, such as small doses of aconite, hyoscyamus, assafœtida, or oxide of zinc.

As before stated, severe itching of the perineum is sometimes dependent on the presence of ascarides in the rectum. In the female these parasites not unfrequently crawl from the anus to the vulva, and give rise to distressing irritation in both situations. In such cases the treatment of the affection is confined to the removal of the cause.

[To the above-mentioned local applications for Prurigo, the following may be added: flaxseed infusion, with bicarbonate of sodium; creasote ointment; cerate of carbonate of lead (plumb. carb. ʒj in cerat. simp. ℥j); ointment of iodoform (gr. x in ʒj); tobacco infusion; equal parts of hydrate of chloral and camphor; dilute solution of hydrocyanic acid; glycerin or glyceramyl; benzoated vaseline, with oxide of zinc.—H.]

SECTION IV.—VESICULÆ.

The Vesicular eruptions are Eczema and Herpes.

Eczema.

Synonyms.—Humid Tetter; Moist scaly Tetter; Running Scall; Dartre vive; Dartre squammeuse humide; Poussée; Schwestblättern; Hitzblätterchen; Eczesis; Herpes squamosus madidans; Ruborescum vesiculis et pruritu.

Definition.—Eczema (ἐκζέω, to boil out or over) is an eruption characterized at its commencement by the development of numerous minute agglomerated transparent vesicles, or by a multitude of small red fissures in the epidermis; afterwards by a superficially-excoriated, moist-reddened surface, exuding more or less abundantly a clear plastic serum, which concretes into buff-colored flaky crusts, and at its termination by a scaly desquamation of the epidermis.

Causes (Predisposing).—Eczema occurs at all ages, but is commoner with the young than with the aged; young children and infants are especially liable to it. It becomes more prevalent at the spring, and again towards the end of the autumn, than at other times of the year. Certain avocations which entail much exposure to the rays of the sun, or to the heat of an oven, or of a furnace, or which necessitate much handling of gritty or irritating substances, predispose to Eczema. Thus it is of common occurrence amongst agricultural laborers, metal-founders, blacksmiths, pastrycooks, bakers, color-grinders, dyers, metal-workers, and grocers. But independently of these causes there is evidently in certain individuals a strong *constitutional* predisposition to the disease which in many instances is hereditary.

The exciting causes of Eczema are the process of dentition, excesses of all kinds, the ingestion of shell-fish or highly-spiced dishes, strong mental emotions whether of an exciting or a depressing kind, want of sleep, excessive fatigue, prolonged exposure to the direct rays of the sun in hot weather, the contact of irritating plasters, of rancid oil, of strong alkali, of mercurial ointment, or of irritating powders, the irritation set up by the presence of the acarus scabiei, or the pediculus corporis.

Description.—Eczema may follow either an acute or a chronic course.

Acute Eczema in its mildest form (*E. simplex*) occurs without previous constitutional disturbance, in the form of slightly-reddened patches, on which are speedily developed numerous minute glistening vesicles containing clear serum. These vesicles have but a short existence. In the course of a day or two, either they subside in consequence of the fluid within them becoming reabsorbed, or they become ruptured and allow it to exude. In the one case the vesicles are replaced by minute furfuraceous scales, in the other by small thin crusts. Whether scales or crusts be formed they soon separate, leaving the skin perfectly sound. The eruption is attended with slight itching and tingling. Its whole course occupies about a week or ten days.

In a severer form (*E. rubrum*) the phenomena of inflammation are more strongly marked. The eruption is preceded by considerable febrile disturbance. The inflamed patches are not only vividly red, but are often considerably swollen, and on examination by touch feel hot and tense. As in the milder variety the reddened skin is thickly sprinkled with minute

transparent vesicles; these may either be succeeded by desquamation, the skin remaining red for some days after their disappearance, or may give rise to a copious exudation of plastic serum, which concretes into thin, moist, cheesy flakes, which are repeatedly cast off and renewed, the skin continuing for several days red, moist, and excoriated. After a time however it becomes drier and gradually loses its redness, while the flaky crusts are replaced by a dry furfuraceous desquamation, and at the expiration of two or three weeks the diseased surface resumes its healthy appearance.

Chronic Eczema.—This consists either of a prolonged series of subacute attacks or of a permanently-diseased condition of the skin. It presents itself under a variety of shapes. In some cases the most prominent phenomenon is an abundant secretion of clear, thin, serous discharge, the diseased skin looking red, swollen, and sodden.

In others the liquid secreted is less abundant but more glutinous, exuding from a number of minute superficial excoriations, or else from a number of little red decussating fissures in the epidermis.

Sometimes the secretion is scantier still, and at the same time of a thicker consistence, so that instead of issuing from the affected skin as a colorless tenacious fluid, it concretes almost as soon as it is formed into thin, yellow, soft, somewhat moist exfoliations. These are not very adherent to the skin beneath in consequence of its comparatively moist condition, but whenever they get detached they are speedily replaced.

In other cases there is but little tendency to a moist secretion; the reddened skin is covered with yellowish semi-transparent flakes, which are pretty firmly adherent to it except at their margins, which are detached, white, and opaque.

In others again the principal character of the disease is a thinned, smooth, tense, and shining condition of the skin, which is sprinkled over with flakes so thin and transparent as to be barely perceptible.

Besides the varieties of form above described, Eczema presents in special situations certain special peculiarities.

Thus on the hand (*E. manuum*) acute Eczema appears in the form of large vesicles which vary in size from that of a millet-seed to that of a split-pea; they usually occur in groups, and are sometimes confluent. Their appearance is attended with much heat and tingling; usually no *itching* is complained of until they have begun to disappear. If the eruption be copious the hands will be red, swollen, and aching. Usually the vesicles do not rupture, but after remaining for some days shrink up and are replaced by a dry desquamation. However, where the epidermis is comparatively thin—for instance, on the lateral surfaces of the fingers or of the hand, or on the backs of the finger-webs—they may be succeeded by the yellow, moist exfoliations that are ordinarily produced by Eczema.

When chronic Eczema occupies a position where the skin is frequently stretched and relaxed by the movements of the part covered by it—*e. g.*, the palm of the hand, the knuckle or flexure of a finger, the angles of the mouth, the margin of the anus, &c.—the red fissures, in place of being (as before described in the general account of Eczema) numerous and merely epidermic, are few and extend deeply into the cutis.

When the eruption is situated near any one of the orifices of the body, it is apt to extend inwards along the mucous membrane of the passage; and conversely certain inflamed conditions of the mucous passages are apt to extend in the form of an eczematous eruption over the skin which is continuous with them. Thus the author has seen an Eczema of the skin around the mouth result from an ulceration of the buccal mucous membrane, caused by the contact of a carious tooth. Very often Eczema of the skin covering the eyelids will extend over the palpebral conjunctiva in the form of granular ophthalmia; and on the other hand granular ophthalmia will extend in the form of Eczema over the integument of the eyelids and cheek. Eczema of the pinna of the ear, again, frequently extends up the meatus externus, and may produce either a form of otorrhœa or thickening of the membrana tympani, and so some degree of deafness. Eczema of the external ear moreover leads to considerable induration and swelling of the pinna, which becomes tender, rigid, and more or less altered in shape.

Chronic Eczema of the leg depends in many cases on a varicose state of the veins of the limb, but, whether arising from this cause or not, it is apt to leave behind it a more or less persistent brown discoloration of the skin.

When it attacks the hairy parts of the body (scalp, axillæ, or pubes), the viscid serous discharge of Eczema, which in these situations is usually pretty abundant, either keeps the hair wet, sticky, and entangled, as happens when the secretion is profuse and comparatively thin; or if less copious and of a thicker consistence it forms, with the entangled hair, dry, firmly-adherent crusts.

Of Eczema of the hairy scalp there are, according to the author's researches, two distinct kinds. The one, which may be distinguished as the constitutional variety, affects chiefly the anterior half of the hairy scalp, and is generally confined

to that portion of it that covers the expansions of the frontal and temporal bones. This species often coincides with E. aurium, and not unfrequently extends over the forehead. It occasions in many instances considerable thinning of the hair. It is sometimes an obstinate affection, and is apt to recur after recovery. The other variety, which may be termed occipital Eczema, occupies chiefly the posterior half of the scalp, and is generally confined to the part covering the occipital bone. This kind, as a rule, is not found associated with Eczema of any other part. It is almost peculiar to children between the ages of two and sixteen years, whereas the constitutional variety is common at all periods after the age of three months. The occipital variety is invariably associated with and depends on the presence of the pediculus capitis ; in the constitutional kind, unless it be associated with the other affection, the pediculus is as constantly absent. The occipital variety moreover is always readily to be got rid of, and does not commonly recur ; it does not produce thinning of the hair.

The Eczematous eruption caused by the *Acarus Scabiei* will be found described under the head of "Scabies."

Eczema is by far the commonest disease of the skin. It is often found associated with some other cutaneous affection, the eruption in such cases partaking of the characters of either disease. Lichen, Impetigo, Pityriasis, and Psoriasis are the diseases with which it is most frequently conjoined. It follows usually a chronic course, and is very apt to return after recovery. It is attended generally with a sensation of burning and itching, and causes occasionally severe smarting, or even aching pains. It is in most cases a constitutional complaint, but sometimes arises solely from parasitic irritation.

Diagnosis.—In considering the diagnosis of Eczema, the frequency with which it coincides with other affections of the skin must be remembered ; those with which it is most commonly associated have been already mentioned. The diseases for which it is most likely to be mistaken are Lichen, Psoriasis, a variety of Erythema, Herpes, Impetigo, and (foliaceous) Pemphigus. In certain situations too it may be confounded with Pityriasis, Erysipelas, bullous Pemphigus, or Scabies. But—

In *Lichen* the quantity of fluid secreted is very small, and the crusts formed by it are minute, dry, and of a grayish color ; the skin too is harsh, dry, and thickened, whereas in Eczema it is smooth, moist, and thinned. In *Psoriasis* the incrustations are dry, white, laminated, and nacreous, and the inflamed skin covered by them is somewhat elevated, dry, creased, and of a tawny-red color. The eruption of Psoriasis, moreover, is usually most developed in the neighborhood of the knees, elbows, and loins. *Erythema intertrigo* may be distinguished by its position (in some fold of the skin), by the thinness of the discharge, and by the ready disappearance of the eruption under treatment. *Herpes* may be diagnosed from Eczema by the larger size of its vesicles, their occurrence in patches of about a dozen or more clustered on circumscribed inflamed areolæ, and their leaving adherent, dry crusts instead of loose, moist, exfoliations behind them. In *Impetigo* the crusts are much thicker than in Eczema ; their surface is nodulated ; on detaching them a suppurating surface is disclosed ; in its early stage the disease is pustular. In *foliaceous Pemphigus* the eruption is more extensive than it ever is in Eczema, the exfoliations are much larger, the liquid secreted by the inflamed skin is less viscid, and there are generally a few bullæ present to aid the diagnosis.

Eczema of the scalp under certain conditions so closely resembles *Pityriasis* as to be scarcely distinguishable from it, but in the latter affection the scales are always drier and more opaque than in the former. E. rubrum affecting the face may be mistaken for *Erysipelas*, but the latter affection occupies, at its first appearance, only a very limited area—generally the bridge of the nose ; the swelling ceases suddenly at the margin of the inflamed patch, and in place of a multitude of small vesicles there are one or two irregularly-shaped blebs. In acute Eczema of the hands, by the union of several vesicles blebs may be produced sufficiently large to simulate the *bullæ of Pemphigus;* but the blebs so formed are often loculated ; clusters of vesicles are to be seen in their neighborhood ; they disappear in the course of a few days, and are not succeeded by others : whereas Pemphigus is almost always a chronic disease. Eczema of the hands is sometimes merely a symptom of Scabies. When this is the case, the eruption is confined chiefly to the interdigital webs and the lateral surfaces of the first phalanges, whereas, according to the author's observations, Eczema of constitutional origin attacks the dorsal and ventral rather than the lateral aspect of the fingers ; again, the former never affects the last phalanges, the latter often does so. The history of contagion, where this can be made out, and the presence of the acarian furrows, will be further means of identifying Scabies.

Prognosis.—Eczema in no way tends to a fatal issue, but it runs usually an extremely chronic course, and is often a very intractable and distressing affection ; it is prone to recur repeatedly after apparently complete recovery, and at each re-

turn to become less and less amenable to treatment.

Treatment.—If Eczema be developed under any external influence, *e. g.*, the irritation produced by constantly handling sugar or lime, the removal of the cause will often alone suffice. In such cases, if the patient be a grocer or builder, it is sometimes necessary that he should change his occupation.

If the eruption be recent and attended with inflammatory symptoms, after a brisk purge, refrigerants and demulcents, such as cream of tartar, mindererus spirit, lemonade, sarsaparilla, or couch-grass tea should be given, at the same time that emollient and sedative applications are employed. For instance, if the eruption be general, tepid baths containing bran or gelatine; or if it be limited to a small area, poultices of ground rice or potato starch, made with an infusion of henbane or lettuce. The use of an evaporating lotion composed of a drachm of Goulard's extract to a pint of distilled water is often an efficient remedy; this lotion being used in the daytime and replaced at night by an ointment containing six drops of the liquor plumbi in an ounce of "vaseline."

If the disease be chronic and the patient of lymphatic temperament, moderate doses (ʒij t. d. s.) of cod-liver oil should be taken; in long-standing cases of this kind considerable benefit is to be derived from small doses of sulphur or of the hepar sulphuris. In the majority of instances the liquor arsenicalis will be of service. Free phosphorus in doses of gr. $\frac{1}{30}$ (dissolved in oil) t. d. s. is also a remedy of unquestionable value. When there is considerable watery discharge the bowels should be kept loose by a saline aperient. If the patient's health be feeble he should take steel and bitters, and his diet should be nourishing, but in any case it should be unstimulating, and all condiments and fermented liquors should be interdicted.

Locally various remedies may be made use of with a view to their exercising either a stimulant, an alterative, an anodyne, an astringent, or an emollient effect on the skin. And in a disease which varies so much in its characters as Eczema the success of any plan of treatment will depend greatly on the judicious selection of the local application and the appropriate adjustment of its strength.

Ointments of calomel, of the nitrate or the subiodide of mercury, of vermilion, of oxide of zinc, of tannin, of camphor, of calamine, of cyanide of potassium; or lotions of borax, potash, bichloride of mercury, acetate of lead, sulphate of iron, nitrate of silver, and the huile de Cade, are the most important topical remedies. The unguentum diachyli of von Hebra (made by softening diachylon plaster with an equal quantity of linseed-oil) is a favorite and useful remedy; so also is the glycerole of the subacetate of lead (*i. e.*, the liquor plumbi made with glycerine in place of water) diluted with from one to seven parts of pure glycerine. [Kaposi[1] has found very serviceable in Eczema, a modification of the unguentum diachyli; made by incorporating together by the aid of heat equal parts of lead plaster and vaseline. Dr. Piffard of New York first recommended the use of this preparation for Eczema.[2]—H.]

Herpes.

Synonyms.—Tetter; Dartre; Zittermahl flechte; Ignis sacer; Erysipelas phlyctænodes; (*Of H. zoster*) the Shingles; la Zone; la Sangle; le Ceinturon; der Gürter; Zostera; Zona repens; Circinus Cingulum; Zona serpiginosa; Zona volatica.

Definition.—Herpes (ἕρπω, to creep or spread), is an acute eruption of comparatively large vesicles which occur in clusters, each cluster being situated on a circumscribed patch of erythematous skin, and separated from neighboring clusters by intervals of sound skin.

Causes.—Herpes *zoster* occurs at all ages. It is commoner in the summer than in the winter. It follows sometimes exposure to cold, sometimes violent fits of passion. At certain irregular periods, cases of H. zoster get suddenly to be very much commoner than they usually are, and an epidemic of the disease, if it may be called so, prevails.

Herpes *labialis* sometimes occurs as an independent complaint, affecting the lining membrane of the mouth and fauces, as well as the exterior of the lips, and attended with slight febrile disturbance; but ordinarily it is an accessory to, and appears in the course of other diseases, such as catarrh, ague, continued fever. Herpes *præputialis* is almost peculiar to adults; it is often associated with stricture of the urethra; by some authors of weight, however, this is regarded as a mere coincidence.

Description.—The varieties of Herpes are H. zoster, H. phlyctænodes, H. labialis, H. præputialis, H. circinatus, and H. iris.

Of these the last two are parasitic diseases, and will be treated of accordingly with other eruptions of that group. *Herpes zoster* or Zona is an acute affection which begins by slight febrile disturbance, a sense of weariness, pain in the loins, and loss of appetite. Then, over a lim-

[1 Wiener Med. Wochenschrift, No. 17, 1878.]

[2 Archives of Dermatology, July, 1876.]

ited region, sensations of heat, or of tingling, or even darting pains may be felt. Shortly, on the regions so affected, appear several circumscribed erythematous patches of irregular shape. These are quite distinct from one another, and vary in size from half an inch to three or four inches across. Their general arrangement is such that they form a wavy interrupted band, which is situated generally on the trunk, where it takes a transverse direction, reaching half round the body on one side (usually the right), commencing at the middle line behind, and extending obliquely forwards and a little downwards, as far as the middle line in front. Shortly after the patches have appeared they become studded with minute transparent vesicles of the size of millet-seeds, and averaging in number from half a dozen to a score on each patch. Most of these continue distinct from one another; but some of them, as they increase in size, become joined with others of the same cluster, so as to form large irregular bullæ. Those however that remain separate rarely exceed the size of a pea.

In either case they soon cease to be transparent, but, retaining their brilliancy, assume a lustrous opaline appearance. This lasts for a day or two, when, about the fifth day of the eruption, the contained fluid gets turbid and inspissated, so that the vesicles become dull, flaccid, and opaque; and, at the same time, the erythematous patch on which they are seated begins to fade. The shrivelled blebs speedily dry up into small brown crusts, which conceal superficial excoriations; the latter soon heal, and the crusts fall off, leaving red stains, which gradually fade away. The number of the groups of Herpes is very variable; the half-belt may either consist of a good many, or be made up of only two or three. The development of the different clusters is not simultaneous; they appear in succession, so that at any given time, during the progress of the eruption, different patches will exhibit different stages of development or decline; vesicles of the same cluster, however, always progress *pari passu*.

The course of the disease is usually completed in from ten days to a fortnight; sometimes, however, it is more protracted: either the vesicles may get accidentally ruptured, and so leave behind them superficial ulcers, which necessarily prolong the disease, or in the aged or cachectic a gray slough (H. gangrenosus) may form beneath and around the vesicle, and leave after its separation a deep painful ulcer, which may take even several months to heal. This condition of the skin is attended generally with hectic fever and great prostration, and the sores leave behind them permanent scars; or, towards the termination of the eruption, more or less severe lancinating neuralgic pains may attack the region occupied by it. These pains are more intense, and are prolonged over a greater length of time in the aged and debilitated than in the young and vigorous. Their duration is usually limited to a few days, but they may continue for several weeks, months, or even years, after the disappearance of the eruption. Zona is almost invariably confined to one side of the body, stopping short both behind and before at the median line, which it rarely transgresses. It has in a few instances been observed on both sides of the trunk, but on these occasions the two halves of the belt did not correspond, the one being situated considerably above the level of the other. (There is a popular notion, which however is without the least foundation, that such cases necessarily prove fatal.) It appears usually on the trunk, the lower part of the thorax being its most favorite locality; but it occurs also on the neck, the face, the head, and the upper and lower limbs. On the limbs its direction is vertical; on the trunk, horizontal; and on the neck, face, and head, partly vertical and partly horizontal. On the trunk the vesicles of Herpes are larger than in the head, neck, or limbs. *H. phlyctænodes* is a division of Herpes that was established on the assumption that the variety just described varied in essential particulars accordingly as it occupied the trunk or other parts, and comprehended all cases of H. zoster occurring elsewhere than on the trunk. *H. labialis* occurs, as its name implies, about the lips. In the place where it is about to appear a sensation of burning and smarting is felt; this is followed slowly by the appearance of a circumscribed red patch, which soon becomes swollen and shining. On this a cluster of small vesicles is speedily developed; some of these may unite to form a small irregular bleb of about the size of a split-pea. The colorless transparent vesicles soon become yellow and opaque, and the burning and smarting sensations subside; the vesicles dry up into small brown crusts, which fall about the seventh or eighth day, leaving red stains, which gradually disappear. H. labialis appears generally at the junction of the mucous membrane with the skin, but often affects the skin at some little distance from the red margin of the lips. It is common at the angles of the mouth, but it may be situated over any part, either of the upper or lower lip; sometimes it forms a complete circle round the mouth. It occasionally appears on the mucous membrane lining the buccal cavity; in this situation the vesicles soon rupture, and are replaced by little white patches of macerated epithelium. *H. præputialis* may

affect either the outer or inner surface of the prepuce, appearing in the form of small, red patches. Each of these is about the size of a fourpenny-piece, is perfectly distinct from the others, and soon becomes covered with a crop of transparent globular vesicles. The eruption is preceded and accompanied by itching, heat, and sometimes smarting of the prepuce. When it affects the outer surface of the foreskin, the vesicles soon become opaque, shrivel, and are replaced by small crusts, which fall about the seventh or eighth day. On the inner surface of the prepuce, the affection is attended with more irritation, and the patches are redder; the vesicles, which soon burst, are replaced by little superficial ulcerations that speedily heal. Sometimes, however, in this situation, the disease is kept up by a succession of eruptions, and assumes a chronic character. The end of the prepuce becomes thickened, wrinkled, and even fissured, and at the same time the margin of its orifice gets gradually contracted and converted into a ring of almost cartilaginous hardness.

Diagnosis.—H. zoster may be mistaken for Erysipelas, Eczema, or Pemphigus; H. labialis for Eczema; and H. præputialis for Chancroid.

However, in *bullous Erysipelas*, the inflamed areola is generally much more extensive than in Zona. On the other hand, the blebs are much less numerous and a good deal larger, besides being irregular in shape; the margin of the erysipelatous surface, too, is distinctly raised. In *Eczema*, although that disease may occur in patches, yet the patches have neither the well-defined margins nor the systematic arrangement of Zona. Again, the vesicles of Eczema are smaller and much more crowded together than those of Herpes. The isolation and the volume of the vesicles of Herpes may cause it to be mistaken for *Pemphigus;* but in the latter, although the bullæ may be small and near to one another, they are never arranged in systematic groups. Zona is an acute, Pemphigus almost always a chronic disease.

From H. labialis *Eczema* may be readily distinguished by the absence of a definite margin, and the minuteness and agglomeration of the vesicles.

H. præputialis is very liable to be mistaken for Chancroid; but the former disease begins as a cluster of vesicles, the latter is almost from the commencement an ulcer. Later, the herpetic scales on the outside of the prepuce can scarcely be confounded with the black, thick crusts of syphilis; nor the herpetic excoriations of the inner prepuce for the chancroid ulcer, which has a yellowish floor, and however shallow it may be, has always abrupt edges.

Prognosis.—In H. zoster, H. labialis, and H. præputialis, prompt recovery may usually be anticipated. H. zoster, however, in old and debilitated persons, is apt to assume a gangrenous form, and to be succeeded by persistent neuralgia; and H. præputialis, when it affects the inner surface of the prepuce, will often assume a chronic character, and become an obstinate and troublesome affection.

Treatment.—Herpes zoster, when it runs its usual favorable course, requires but little treatment. If there be much febrile disturbance at the commencement, diluent drinks should be given, and a light diet enjoined. The bowels should be regulated, if necessary, with mild aperients, and (if the eruption be considerable) the patient be directed to remain quiet. In the employment of local remedies some caution should be exercised, for applications that would seem to be indicated by the acute inflammation of the skin, such as poultices, fomentations, and emollient lotions, macerate the walls of the vesicles, facilitate their rupture, and so, as has been seen, not only prolong the course of the disease, but add considerably to the discomfort attending it. The best lotion, if a lotion be used, is a solution of the acetate of lead; but it will generally be better to oil the surface with almond- or olive-oil, and then to dredge it over lightly with starch-powder. This plan is very efficacious in protecting the vesicles from rupture, and, in an uncomplicated case, to preserve them unruptured is the main object in view. When the vesicles have dried up, a few warm baths may be taken to facilitate the separation of the crusts. Should the vesicles become accidentally ruptured, the ulcers should be dressed with ung. plumbi subacet.; or, if painful, with an ointment made with moist extract of opium (a drachm to the ounce and a half of simple ointment). When the disease occurs in old or cachectic persons, their general health should be attended to. In the gangrenous form, such tonics as bark or quinine, stimulants, and a nutritious diet, should be prescribed; locally, stimulating lotions, or dusting the surface over with sulphate of quinine, are the best remedies. When the eruption is complicated with neuralgic pains, an ointment of belladonna or aconite-liniment, containing to the ounce half a drachm of the former, or two drachms of the latter, may be employed locally, while the tincture of either of these plants is given internally. If there be much anæmia, the milder preparations of iron, in small doses, will be of service in relieving the pain. When the eruption has altogether disappeared, the application of blisters, and dusting

the blistered surfaces over with small quantities of morphia, will often succeed in arresting the neuralgia. The hypodermic injection of a solution of a salt of morphia, gives speedy and often complete relief. The thermic hammer, the linimentum chloroformi et belladonnæ, moxas, and, in desperate cases, section of the affected nerve, are also valuable resources.

H. labialis is always a trivial affair, and requires scarcely any treatment. The application of such liquids as lead-lotion containing a little proof-spirit, glycerine, a mixture of a drachm of the liquor plumbi subacetatis with an ounce of fresh cream, &c., is all that is necessary.

H. præputialis, if acute, needs only the simplest treatment. When situated on the outside of the prepuce, it requires chiefly protection from the friction of the dress. When the inner surface of the foreskin is affected, the urine should be rendered bland and unirritating by the administration of diluents and demulcents, and a piece of dry lint be introduced between the glans and prepuce to prevent contact of their surfaces, and to absorb irritating secretions. If there be much irritation, emollient lotions should be injected carefully beneath the prepuce, and the penis bathed frequently in warm water. In the chronic affection, citrine ointment, or carbonate of zinc ointment, is requisite; and Plummer's pills, or the alkaline sulphurets, should be administered internally. When the præputial orifice has got much contracted, operative interference becomes necessary.

[The *poison-vine*, *Rhus toxicodendron*, very common in the United States, produces with a certain number of persons, when touched, an unpleasant herpetic eruption. The same effect is caused in a smaller number of people by the swamp sumac, *Rhus verenata*. This affection usually lasts several days; sometimes from one to two weeks. In its treatment, I have found advantage in the early use of lead-water. This is unsuitable, however, after any of the vesicles have become broken. Dr. Edward Hartshorne has found the fluid extract of serpentaria, locally applied, to be successful. Dr. S. A. Brown, U. S. N.,[1] asserts that bromine is a specific for it; having given relief within twenty-four hours in forty cases. He prefers for its use a solution of bromine (ten or twenty drops to the ounce) in olive oil or vaseline. This is gently rubbed in three or four times daily, and is occasionally washed off with Castile soap and water. Prof. Maisch, of Philadelphia, has ascertained by analysis and experiment that the active principle of the poisonous species of *rhus* is toxicodendric acid. In accordance with this observation of its nature, alkaline remedies are indicated. Lime-water is often beneficial. I have found the bicarbonate of sodium to produce much relief, and hasten recovery. Dr. W. E. Brandt,[1] of Indiana, has reported rapid cures with a saturated solution of hyposulphite of sodium, constantly applied to the eruption.—H.]

[1 N. Y. Med. Record, April 20, 1878.]

SECTION V.—PUSTULÆ.

The pustular eruptions are Ecthyma and Impetigo.

Ecthyma.

Synonyms.—Phlyzacia; Boutons; Epinyctis; Ecchymata; Echrasmata; Terminthus; Thyma.

Definition.—Ecthyma (ἔκθυμα, a pustule) is characterized by an eruption of large, rounded, discrete, flattened pustules, resting on an inflamed base, and giving rise to the formation of a dark-colored adherent crust, which, on separating, discloses a brownish- or purplish-red stain, which is slow to disappear.

Causes.—The predisposing are dirt, poverty, hunger, exposure to cold and moisture, prolonged mental excitement, excessive bodily fatigue, drunkenness, debauchery, watchfulness. The disease is consequently commoner with the poor, the aged, and the dissipated. It sometimes follows an attack of specific fever, *e. g.*, scarlet fever, measles, typhoid fever.

But, independently of these causes, it may be excited by the contact of local irritants, *e. g.*, tartar-emetic, sugar, lime, iron-filings; thus it is often seen on the hands and forearms of grocers, bricklayers, and workers in metal. There is another local irritant to which a large proportion of the cases of Ecthyma are due, viz., the acarus scabiei.

People in whom Ecthyma may thus be excited by mere local irritation are as a rule of the lymphatic temperament. The disease is not contagious, but it is inoculable.

Description.—Ecthyma may follow either an acute or a chronic course.

Acute Ecthyma is preceded by more or less feverishness, and (usually) by tingling, pricking, or smarting of the surface about to be affected. The eruption, which is confined to a limited area, appears at first in the form of elevated, rounded, red patches of the average size of a pea, and distinct from one another. These patches become speedily changed into lenticular pustules of corresponding size with red areolæ. After a few days the pustules dry up, and are replaced by hard, dark,

[1 N. Y. Med. Record, July 12, 1879, p. 46.]

thick crusts, which, on separating, disclose dusky-colored red stains, which may last for a considerable time. Generally several crops of pustules appear during the course of the eruption, which extends usually over about ten days or a fortnight. This variety is seen more commonly on the limbs and neck than on the trunk or head. It is attended sometimes with considerable inflammation of the surrounding skin and of the neighboring lymphatic glands, and not unfrequently is complicated with furunculi. This is the commonest variety of Ecthyma, and hence was called by Willan *E. vulgare*.

Chronic Ecthyma differs from the acute variety not only in duration, but also in extent. The later crops of pustules, instead of occupying the same region as their predecessors, invade successively fresh portions of skin. Again, the febrile disturbance which is associated with the eruption, instead of commencing a few hours before, and subsiding a few days after the appearance of the latter, assumes a hectic type, and becomes gradually more marked as the eruption progresses. This variety sometimes affects infants at the breast (*E. infantile*), who are reared under unfavorable hygienic circumstances. In infants it attacks chiefly the regions which are most exempt from the acute variety, viz., the face and chest. It is a serious affection, since it is apt to become complicated with diarrhœa and copious sweating, and in a large proportion of cases terminates fatally. Chronic Ecthyma occurs also in adults whose vitality has been lowered by dissipation, grief, privation, or old age (*E. cachecticum*). In this variety the pustules are larger and flatter, as well as more flaccid, than in either of the preceding; they are surrounded by a livid-red areola, and contain a dark-colored sanious pus; they are replaced by hard, flat, black crusts from beneath which a dirty, ill-smelling discharge exudes; on detaching one of these crusts, a pale, flabby ulcer is disclosed. E. cachecticum affects especially the lower limbs; it may last indefinitely.

Diagnosis.—The diseases with which Ecthyma is most likely to be confounded are Rupia, Impetigo, Acne, Furunculi, and pustular Syphilides.

Between *Rupia* and Ecthyma there is certainly a great analogy, and some authors of repute have classed them under one name. But in Rupia the elevation of the epidermis is broader, and the contents of the bleb, when recent, are serous. Again, the crusts of Rupia are stratified and are always decidedly thicker at the centre than at the circumference.

In *Impetigo* the pustules are much smaller, and much more numerous; they are clustered together and are often confluent; the crusts are more uneven, are lighter-colored, softer, and moister, as well as more extensive than those of Ecthyma.

In *Acne* the pustules, which are small and acuminated, rest generally on a non-suppurating, elevated, indurated base; they are confined to the face, shoulders, or chest.

From the *Pustular Syphilide*, which is an occasional variety of infantile syphilis, infantile Ecthyma may be distinguished by the absence of mucous tubercles.

In *Syphilitic Rupia* the coppery areola around the bleb, the greenish tint of the crusts, the deep ulcer it covers, the long course run by each bleb, and the general history of the case, will serve for differential diagnosis.

Prognosis.—This will vary according to the cause of the disease: Thus, when the Ecthyma has been produced by local irritation, a speedy and complete recovery may be anticipated. So also with acute Ecthyma, at least in the majority of cases. In the cachectic variety the prognosis should be guarded. And in infantile Ecthyma a fatal result is to be apprehended.

Therapeutics.—Acute Ecthyma requires only very simple treatment. Refrigerant drinks, slight laxatives, and local emollient baths, comprise all that is necessary. In chronic Ecthyma it is of the first importance to remove the patient from amongst the causes which have depraved his health.

In infantile Ecthyma a good wet-nurse is often essential to recovery. Scrupulous cleanliness, pure air, and regular repose, are of scarcely less importance. Cod-liver oil, and bark, and ammonia should be given internally, and the condition of the bowels should be carefully regulated. The sound as well as the affected skin should be powdered with a mixture of sulphate of quinine and lycopodium.

In *cachectic Ecthyma* change of air, especially removal to some suitable part of the sea-coast, light animal food, fresh (cooked) vegetables, and a moderate allowance of alcoholic stimulant, should be enjoined. At first small doses of opium (gr. $\frac{1}{2}$ ter quotidie) will be found of service. Afterwards ammonia, valerian, bark, quinine, and the preparations of iron, should be employed. Externally alkaline, sulphurous, or sea-water baths should be used. The local applications should be stimulating, and the dressings should be as light and simple as possible. All relaxing applications, such as water-dressing covered with oil-silk, poultices, and, above all, plasters should be avoided.

IMPETIGO.

Synonyms.—Crusted tetter; Cowrap; Dartre crustacée flavescente; Lepre hu-

mide ; Nässende grind ; Melitagra ; Psydracia ; Lichen vitiligo ; Ecpyesis impetigo ; Porrigo favosa ; Crusta lactea.

Definition.—Impetigo (Impĕto, to attack) is an eruption of minute pustules set closely together and producing thick, moist, yellowish scales.

Causes.—The lymphatic temperament, hereditary transmission, dentition, impaired health, the seasons of spring and autumn, exposure of the skin to the contact of certain irritating substances, viz., sugar, lime, metal-filings, or of irritating secretions. The irritation produced by linseed poultices, or by certain parasites of the skin, viz., the acarus scabiei, the pediculus capitis, the achorion schönleinei.

Description. — Impetigo begins as an eruption of numerous minute yellowish pustules of the size of a pin's head or that of a millet seed, closely clustered together on a more or less reddened portion of the skin. In a day or two the pustules burst, and their opaque viscous contents exude and dry up into a yellowish crust, from beneath the edges of which a purulent discharge exudes. Since it is in this latter condition that the disease generally comes under observation, it is of more importance for the purposes of diagnosis to be acquainted with the characters of the scab than of the pustules which produce it.

The scabs of Impetigo form moist, yellowish, thick patches. Their surface is uneven and often nodulated. Their color is a dull yellow, tinged often with green or brown. When a crust has lasted for some time, its surface becomes slightly lamellated, so as to give it a somewhat flaky appearance. When the disease is spreading, fresh pustules may be seen around the edge of the crust. On removing a portion of a crust, a raw, moist, suppurating surface of a pale pink color is disclosed.

Varieties.—The principal are *I. figurata* and *I. sparsa.* In I. figurata a large number of pustules crowded together on a limited surface give rise to a circumscribed patch of the disease. In I. sparsa the pustules are scattered over a large extent of surface in small groups. When Impetigo figurata occurs on the whiskers, moustache, or beard, it is termed *I. sycosiformis*, from its resemblance to Sycosis. When it affects other portions of the face it is called *I. larvalis* (larva, a mask).

Impetigo sparsa of the hairy scalp, when it produces small, thick, dry, brownish scabs, is termed I. granulata. When the disease partakes of the character of I. figurata as regards the crowding of the pustules, but resembles I. sparsa in the extent of surface covered, so that, *e. g.*, the whole of the forearm or the whole of the leg becomes encased in a scab, it is called I. scabida. Impetigo is rarely preceded or attended by any febrile disturbance, or with any kind of local sensation. It occurs most commonly in children, affecting especially children of lymphatic temperament. When it occurs in adults it happens most frequently to the obese and flabby, or to those of broken-down constitution. It is in a large proportion of cases a constitutional disease, but it is not uncommonly a mere phase of Scabies. Very many of the cases of Impetigo of the scalp occurring in children are, according to the author's researches, entirely dependent on the irritation set up by the pediculus capitis ; in such cases the occipital part of the scalp is almost invariably the part chiefly affected, the sincipital part of the scalp being almost, if not altogether, free from eruption ; he has found the converse to be the rule in cases of constitutional Impetigo affecting the scalp. Again, the former appears most commonly as I. granulata, whereas the latter assumes usually the characters of I. figurata.

Diagnosis.—The diseases for which Impetigo is liable to be mistaken are Eczema, Ecthyma, Sycosis, Tinea favosa, pustular Lupus, and syphilitic Rupia. But in *Eczema* the discharge is transparent, the scabs are thin and lamellar, and in the early stage vesicles take the place of pustules. Notwithstanding these differences, however, there is between Eczema and Impetigo a very close analogy. In *Ecthyma* the pustules are large, few in number, and discrete, and the crusts small and dark-colored. From *Sycosis*, I. sycosiformis may be distinguished by the lack of subcutaneous inflammation and induration, and by its not (until after very long continuance) producing local alopecia. From *Tinea favosa*, Impetigo of the scalp may be distinguished by the fact that, although the latter often produces more or less thinning of the hair, it never leads to extensive alopecia ; again, its dull brownish-yellow crusts have but little resemblance to the bright sulphur-colored cup-shaped incrustations of favus. The absence of deep ulceration and subsequent cicatrices, will distinguish Impetigo from *pustular Lupus* and from *Syphilitic Rupia.*

Prognosis.—This, as Impetigo never threatens life, is confined to the probable duration of the disease. An acute attack lasts usually two or three weeks. In the chronic state the disease may last several months. After recovery the disease is apt to recur. It is in scrofulous persons that the disease assumes its most chronic and obstinate phase, and is most apt to reappear.

Treatment.—In acute Impetigo the diet should be restricted ; laxative and refrigerant medicines should be administered ; and the local applications should be emollients, such as warm decoctions of

marsh-mallow or of poppies, infusion of linseed or almond-mixture, or poultices of bread or of ground rice, followed by light dressings of oxide of zinc or acetate of lead ointment.

In chronic Impetigo the most efficient internal remedies are cod-liver oil, the various preparations of iron, bitter tonics, the sulphurous mineral-waters, and occasional laxatives. Externally, ointments of precipitated sulphur, of the nitrate, the oxide, or the bichloride of mercury, or the huile de Cade, or lotions of alum, tannin, chloride of zinc, or hepar sulphuris, are the best applications. When the purulent discharge is thin and profuse, a mixture of tannin and starch in suitable proportions should be dusted over the part.

In all cases of Impetigo of the scalp the head should be shaved, or at least the hair should be cut close. When the occipital region of the scalp is the part chiefly affected, the application of ammonio-chloride of mercury ointment should form a part of the treatment.

SECTION VI.—BULLÆ.

The bullous eruptions are Pemphigus and Rupia.

Pemphigus.

Synonyms.—Water-blebs; Blister tetter; Dartre bulleuse; Angine pemphigöide; Blasenausschlag; Pompholix; Morbus vesicularis; Phlycteme; Hydroexanthema bullosum; Morbus phlyctenöides.

Definition.—Pemphigus (πεμφιξ, a bleb) is a disease characterized by the development of a greater or less number of clear watery blebs on inflamed red surfaces; these little bladders, being readily ruptured, give rise at first to excoriations, and afterwards, by the concretion of their liquid contents, to thin crusts.

Causes.—Exposure to cold and moisture; bad or insufficient food; mental distress (rarely), pregnancy. The debility that is associated with chronic Pemphigus is sometimes the cause and sometimes the effect of the disease.

Description.—Pemphigus may follow either an acute or a chronic course.

Acute—a much rarer affection than chronic—Pemphigus is of three kinds.

In the one (*P. solitarius*) an extremely rare variety, which is seen only in old persons, there appears, usually on the shank, a single bulla of about the size of a nut; this rapidly increases in size. When fully formed it produces a painful feeling of tension. After remaining stationary for a day or two, the bulla becomes flaccid, and at the expiration of a week disappears; a second and sometimes a third bulla may appear near the situation of the first. The appearance of each bleb is preceded by burning and itching, and sometimes by redness.

In another variety (*acute general Pemphigus*), less rare than the preceding, the eruption, preceded for a day or two by febrile disturbance, appears in the form of small circular rose-red patches. In the course of a few hours the centre of each patch becomes opalescent and somewhat raised, and in a short time a transparent bleb, surrounded by an erythematous ring, is developed; in a few days the bulla attains its full growth. Its production is accompanied by itching and tingling. Its manner of disappearing is not in all cases the same. In some instances the serum is gradually reabsorbed, so that the bulla shrivels, and is replaced by a dry foliaceous desquamation; but more commonly the bleb bursts and the serum escapes, disclosing a more or less extensive excoriation. This may either get covered by a thin dark-colored crust, which after a time falls off, or the epidermis becomes reapplied to the excoriated surface, which heals under it. In either case a violet stain is left, which may last for some time. The duration of each bulla is about a week, but by a succession of several crops of bullæ, the disease is generally prolonged for about three weeks or a month.

The remaining variety of acute Pemphigus is peculiar to new-born infants, and affects only the palms of the hands and the soles of the feet. The blebs, which contain a transparent yellow serum, vary in size from that of a pea to that of a small bean; each of them is encircled with a dusky violet-colored areola. They soon rupture and get replaced by superficial ulcers, which become covered by thin black crusts. The ulcers spread by the formation of fresh bullæ. This variety is supposed by some authors of weight to be a form of infantile syphilis. It is accompanied by sickness, diarrhœa, and marasmus, and is apt to terminate fatally.

Chronic Pemphigus, in its ordinary form, may either succeed to acute general Pemphigus, or may from the first maintain a chronic character. It differs from the latter disease in being preceded by only slight febrile disturbance, in the absence of a red areola around the bullæ, which moreover are less tense and transparent than in the acute variety, and in the more chronic character of the ulcers left after the blebs. It resembles the acute disease in producing a succession of crops of bullæ. These may follow one another at intervals of only a few days, or may be separated by such a pause as to induce the belief that permanent re-

covery has taken place. When so long a term intervenes, the succeeding crop assumes much of the character of an acute attack.

Sometimes the variety just described may lead to another more serious condition (*foliaceous Pemphigus*). The bullæ increase in number, become confluent, and appear in quicker succession, till at last they become so crowded and succeed one another so rapidly that they are unable to go through the usual phases. They have scarcely formed when they rupture, and leave the surface covered with little lamellar crusts, which resemble pretty closely in color, consistence, and thinness, the layers of a piece of light pastry. These flakes, which adhere but loosely to the skin, being curled up much in the same way as the loose bark of a sycamore tree, are readily detached and as readily reproduced. The skin itself is moist, exuding a fetid, nauseating, serous discharge. This foliaceous condition of the skin is apt to invade the whole surface.

Pemphigus, although a comparatively rare, is always a grave affection: in the acute form, on account of its tendency to recur and finally pass into the chronic state; and in the chronic form on account of the debility and emaciation that are induced by it. Pemphigus may occur at any age, and may appear at any part of the surface. In the chronic condition it is apt to be complicated with obstinate diarrhœa. It is sometimes attended with severe itching (pruriginous Pemphigus).

Diagnosis.—Pemphigus may be mistaken for Herpes Zoster, Rupia, Ecthyma, Impetigo, or Erysipelas.

Herpes zoster may be distinguished by its tendency to form a half-zone round the trunk by the smaller size of its blebs, which rarely exceeds that of a pea, and by the severe neuralgic pain that often accompanies it.

In *Rupia* the bullæ are fewer in number, are flatter, and are less commonly arranged in groups than those of Pemphigus; the crusts, too, are thicker and are conical, and rest upon actual ulcers.

In *Ecthyma* the liquid that raises the epidermis is always purulent, and the crusts are black and thick.

The crusts of *Impetigo* may always be distinguished from those of Pemphigus by their greater thickness, their yellow color, and their brittleness.

In *Erysipelas* the blebs are irregular in outline and are flatter, and the intervening skin is shining, swollen, and inflamed.

Prognosis.—In acute Pemphigus (excepting P. neonatorum) the probability as regards the individual attack is always in favor of recovery, but a relapse is to be apprehended.

When the disease is chronic, the prognosis should be guarded on account of the intractable nature of the disease, and its tendency, when it has become extensive and has assumed the foliaceous condition, to terminate fatally.

In P. neonatorum the prognosis is grave.

Treatment.—Acute general Pemphigus should be treated by diluent drinks, by laxatives, and by emollient applications. Care should be taken to avoid rupturing the bullæ, or, should they have burst, to prevent the epidermis getting rubbed off from the raw surface protected by it; with this view rest should be enjoined, and the affected skin may be dusted over with "violet-powder." Any raw surface should be dressed with some soothing and gently-astringent ointment, *e.g.*, ung. zinci. oxid. P. neonatorum, P. solitarius, and chronic Pemphigus all require the same general treatment. A generous diet, a moderate allowance of wine, tonics—quinine, iron, arsenic, and small opiates. As regards the local treatment, the blebs, unless of considerable size, should not be punctured. The raw surface left after the rupture of a bleb should be dressed with ointment or lotion of the acetate of lead; or, if the ulcer exhibit a tendency to take on a chronic condition, with a lotion of the nitrate of silver. When there is much tenderness and pain, the ung. gallæ c. opio is an excellent application.

Rupia.

Synonym.—Ulcus atonicum.

Definition.—Rupia (ῥυπάω, to be foul and filthy) is an eruption of large, flat, discrete bullæ, which contain at first a serous, and afterwards a purulent fluid, and which produce dark crusts, thicker at the centre than at the circumference, covering shallow ulcers.

Causes.—Insufficient or unwholesome food, poverty, dirt, privation, damp habitation, an unhealthy atmosphere, drunkenness, old age, a recent attack of scarlatina or of smallpox.

Description.—In its mildest form (*R. simplex*) the disease appears in the form of small, rounded, but flat blebs, the diameters of which vary from that of a three-penny-piece to that of a shilling. These are moderately distended by a thin, opalescent, serous liquid, which soon gets purulent, and at the same time inspissated, so that the blebs become flaccid, and finally dry up into uneven brown crusts which are thicker at the centre than at the circumference. These crusts are readily detached, and leave superficial indolent ulcers, which finally cicatrize, leaving behind them livid red stains, which may persist for some time. While these

changes are taking place in the first crop, fresh bullæ continue to be formed, which follow the same course, the disease lasting altogether about a fortnight or three weeks. This variety approaches very closely in its characters to Ecthyma, and is considered by several authors of repute to be identical with it.

In a severer form (*R. prominens*) the disease commences as small rounded, inflamed spots, on which bullæ become speedily developed. The serum contained in these is often dark-colored and sanious, and is usually of thicker consistence than in the preceding variety. The blebs are replaced by thick dark-colored crusts, which are surrounded by a dusky erythematous areola. This areola soon becomes converted into an annular purulent bleb, which in its turn becomes converted into a scab. In this manner the crust, by successive additions at its circumference and under-surface, acquires a conical shape. In some cases the growth at the under-surface makes greater progress than that at the circumference, and the crust acquires the appearance of a limpet-shell; in others the growth at the circumference is more rapid, and then the crust is flatter, and has much of the form as well as the laminated appearance of an oyster-shell. In either case the crusts are generally dry, hard, dark-colored, and pretty adherent, so as to acquire often a considerable thickness; when detached, a pale, spongy, ragged ulcer is disclosed, which bleeds on the slightest touch, and is deep in proportion to the duration of the crust; this slowly cicatrizes and leaves a purplish stain, which remains for some time.

R. escharotica is a variety still more severe; it attacks sickly infants, commencing by livid-red patches, on which bullæ, containing a dark sanious fluid, become developed, the bullæ spread, and instead of forming crusts, leave open foul, ragged sores, with livid, raised edges. These sores are very slow to heal, and are moreover extremely painful, so as to prevent rest; they are generally attended with fever; several of them appear in succession.

Rupia attacks preferably the loins, nates, and lower limbs, but occurs also on other parts of the body. It may appear at any period of life, but is commoner in childhood and old age.

Diagnosis.—Rupia is liable to be mistaken for Ecthyma, *Syphilitic* Rupia, and Pemphigus.

In *Ecthyma*, although it originates in similar causes and bears a considerable resemblance to Rupia, yet the crusts have not the conical formation, nor are they accompanied by the decided ulceration produced by the latter disease.

Syphilitic Rupia, again, closely resembles the simple disease, but its crusts are even blacker and harder, and have often a greenish tinge; they cover much deeper ulcers, the floors of which are covered with a gray pultaceous substance, and the edges of which are perpendicular; the areolæ around them are coppery instead of livid, and there are always other syphilitic symptoms to aid the diagnosis.

Prognosis.—With the exception of R. escharotica, Rupia is not in itself dangerous to life. When death occurs in the course of it, the result is due to the general state of health which caused the disease, and not to the disease itself; recovery, however, always takes place slowly.

Treatment.—It is of the greatest importance to improve the patient's general health, and to remove the causes which have depraved it. Light, easily-assimilable animal food and fresh vegetables, an occasional laxative, small opiates, bitter tonics, chalybeates, good malt-liquors, wine, cod-liver oil, and mineral acids, are the most important internal remedies.

Externally, tepid, alkaline, or sea-water baths, and gently-stimulating local applications, aided by an occasional pencilling with nitrate of silver, are useful. When the legs are affected with Rupia, the recumbent posture, with the legs somewhat raised, greatly facilitates recovery.

In obstinate cases a sea-voyage is much to be recommended. In R. escharotica, to support the strength and allay pain, and locally to employ anodynes, antiseptics, and emollients, are the chief maxims.

SECTION VII.—TUBERCULA.

The tuberculous eruptions are Lupus, Cheloid, Verruca, Acne, and Molluscum.

Lupus.

Synonyms.—The Wolf; Corroding tetter; Esthiomène; Dartre rongeante; Dartre vive; Dartre ulcérée; Dartre phagédénique; Fressende Flechte; Herpes exedens; Herpes ferox; Herpes serpiginosus; Darta maligna; Lupus vorax.

Definition.—Lupus may be defined as an extremely chronic disease of the skin, affecting young persons, associated with the lymphatic temperament, and often with scrofula, characterized at first by purplish redness and more or less swelling of the affected skin, and terminating in the formation of a permanent cicatrix with or without previous ulceration.

Causes (predisposing).—The lymphatic temperament; the scrofulous diathesis; childhood; the female sex; hereditary transmission; unhealthy habitation; unwholesome or insufficient food; a moist atmosphere; confinement.

(Exciting).—Sudden alternations of heat and cold ; local irritation of various kinds.

Of these causes the most active are temperament, diathesis, and age. Lupus may be said to have invariably associated with it a lymphatic temperament, and it is evidently closely allied to, if not identical with, scrofula. Although owing to the great length of time over which its course extends it happens to be met with in middle-aged and even in elderly persons, yet its *first appearance* dates in most cases from childhood, and it is extremely rare for it to appear after adult age has been attained. Sex has not much influence in its development, still it is somewhat commoner in females than in males. Hereditary transmission has but little influence in its production, except in so far as it affects temperament and diathesis. The remaining causes that have been enumerated as predisposing to lupus are only accessory to the preceding.

Description.—Lupus is met with most frequently on the face, affecting usually the nose or the cheek, but it occurs also on other parts of the body.

There are three varieties of this disease, viz., the erythematous, the pustular, and the tubercular.

Erythematous Lupus commences as a rounded, slightly-elevated, shining, lakish-red patch, not larger than a fourpenny-piece ; on this after a while desquamation takes place. The scales that appear are white and opaque, and are arranged often in thin, curved, wavy, bands, which adhere firmly to the skin beneath. The patch spreads very slowly at the circumference, while the centre heals and becomes a thin, polished, slightly-depressed, white, indelible scar. This cicatrization takes place without any preceding ulceration, and is the effect of interstitial absorption.

Pustular Lupus begins, like the preceding variety, as a somewhat raised blackish or livid patch. On this shortly appear a few minute pustules of the size of a pin's head, or in some cases one or two rupial blebs of the size of a split-pea. After about a week's duration they rupture and exude a plastic liquid, which concretes into a white, a yellowish, or a drab-brown crust. This crust, like the scales of the erythematous variety, adheres pretty firmly to the skin beneath it. On detaching it with the finger-nail, it is seen to cover a ragged shallow ulcer, the floor of which is formed of pale-pink flabby granulations. Around the crust the disease slowly spreads by the extension of the livid elevation and the formation of fresh pustules or mattery blebs, which in their turn give place to crusts, while after a certain time the crusts at the centre fall off and disclose a white cicatrix which is more depressed, more opaque, thicker, and more uneven than the scar of the preceding variety.

Tubercular Lupus at its commencement occurs as a cluster of about half a dozen small, rounded, dusky-red, soft, elastic elevations, of a size varying from that of a hemp-seed to that of a pea ; they may be either distinct from one another, or agglomerated. They are generally accompanied by more or less infiltration of the cellular tissue beneath and around them.

Lupus hypertrophicus. — This is sometimes so considerable as to cause the disease to resemble Erysipelas.

The patch slowly extends by the formation of fresh tubercles around the original cluster.

Tubercular Lupus may follow either of the following courses :—

It may terminate in cicatrization without previous ulceration.

Or superficial ulceration may take place, as in the case of pustular Lupus.

Or deep ulcers may be formed (*Lupus exedens*). The cicatrix left by these, when they have healed, is thicker, more opaque, and more uneven than that of any of the preceding varieties. It resembles very closely the puckered scar of a severe burn, and has the same property of gradually but rigidly contracting, so as to occasion the most serious deformities.

Or (lastly) the granulations that form the floor of the ulcers, produced either by pustular or tubercular Lupus, may become hard and dry, and acquire a thick tough layer of epithelium (*warty Lupus*). This (warty) condition is succeeded, like all the varieties of Lupus, by a permanent scar, with or without previous ulceration.

Lupus in any of its forms is a comparatively rare disease. It is, as a rule, unattended either with itching or "burning."

In some cases, although they are comparatively rare, a long slanting patch of Lupus will eventually become the seat of a well-marked epithelial cancer.

Prognosis.—Although Lupus in no way endangers the life, or even the health of the subject of it, and may even, in cases of long standing, coincide with excellent general health, yet its proneness to attack the face, the ravages that, if unchecked, it commits there, its tenacity when it has once gained a footing, and its obstinacy under treatment, render it a very serious affection. When it attacks the eyelids it is apt to affect both the outer and the inner (conjunctival) surface of the lid, and in such case, if the disease happen to be other than of the most superficial kind, it meets from opposite surfaces in the cartilage of the lid, and the result is the total destruction of the lid, a constant flow of tears over the cheek, and the establishment

of obstinate granular ophthalmia, followed sometimes by opacity and ulceration of the cornea, staphyloma, and permanent loss of vision.

When the nose is affected the same kind of result is apt to ensue; the disease creeps equally up the mucous and the cutaneous surface of the nostrils, and the result is often the total destruction of the cartilaginous portion of the nose.

So again, when the disease attacks the mouth, the face is apt to become much deformed by the disappearance of a greater or less portion of one or other of the lips. The external ear is apt to suffer in the same way.

Nor is it necessary that the disease should attack some one of the above-mentioned parts in order to produce considerable deformity. When the cheek alone is affected, if the ulceration have extended at all deeply, the gradual but irresistible contraction of the scar that is produced draws down and everts the lower eyelid of that side, so that the eye can no longer be completely closed; but besides this, the scar occasions considerable distortion of the features by drawing up the skin from other directions as well.

When the ulceration extends deeply it spares nothing: bone is as readily destroyed as muscle.

The prognosis, both as regards the extent of deformity likely to be produced, and the prospect of speedy recovery, will be far more favorable in the erythematous variety and in cases of tubercular Lupus, which exhibit a disposition to cicatrize without ulceration taking place, than in cases either of tubercular or pustular Lupus in which ulceration has taken place. The existence of much puffy infiltration of the subjacent cellular tissue is to be regarded as an unfavorable prognostic symptom.

The longer the disease has already lasted, and the more pronounced the scrofulous appearance of the patient, the more unfavorable will be the prognosis.

The most prolonged case of Lupus I have met with was in a lady a little over fifty years of age, who had been affected with the disease ever since she was three months old. It is common for Lupus to endure for ten or a dozen years.

Diagnosis.—Erythematous Lupus may be mistaken for Erythema papulatum, for Pityriasis, for Psoriasis, for Herpes circinatus, or for a Syphilide; but in Erythema papulatum the eruption has a much shorter duration; the patches are numerous, the limbs are affected.

In Pityriasis the skin is rough, the scurf is bran-like and not firmly adherent to the reddened surface, and there is usually itching.

In Psoriasis the scales are nacreous, are thicker, are stratified. The skin is harsh, or if smooth (Eczematous Psoriasis), is moist. The patches are usually numerous and widely spread, and if the eruption appears on the face, the eyebrows generally are chiefly affected. If the patches of Psoriasis be ringed there will be no cicatrix in the centre of the ring. Whether ringed or nummular, Psoriasis usually occasions itching.

In Herpes circinatus, the reddened skin is of a pink color, is rough and harsh, and is far from being shining. The patches increase rapidly, and there are generally several of them. The centre of each of the patches, although less raised and somewhat paler than the circumference, offers no resemblance to a cicatrix.

From any similar syphilitic patch, erythematous Lupus may be distinguished by its limited extent, the extreme slowness of its progress, and the absence of any other signs of constitutional Syphilis.

Pustular Lupus might be taken for Impetigo, but the latter eruption progresses far more rapidly, the duration of its pustules is much briefer, the crust that succeeds them is of a lighter color and softer consistence, and is less firmly adherent to the skin beneath it; the surface covered by the crust is not an ulcer. The eruption is usually more extensive, and less abruptly defined.

Tubercular Lupus, in its earlier stages, may be confounded with tubercular Syphilide, especially with the clustered, non-ulcerating kind; but in the latter eruption, the tubercles are firmer and tawnier, and begin to ulcerate much sooner, there is no puffy infiltration of the cellular tissue beneath and around them, and there are usually with them other symptoms of constitutional Syphilis.

In the ulcerated condition either pustular or tubercular Lupus may be confounded with an ulcerating tertiary Syphilide; but whereas the syphilitic ulcer has even perpendicular walls, as if it had been cut out with a punch, and a gray slough-like floor, and is moreover surrounded by a coppery-red areola, the ulcer of Lupus has irregular scolloped walls, which are often undermined, so that they overhang the circumference of the floor of the ulcer; the floor of the ulcer is composed of pale-pink flabby granulations, and the margin of the ulcer is surrounded by a purple-red areola.

The ulcer of Lupus may be taken for an ulcerating epithelial cancer, but the latter disease commences commonly in old age. The ulcer produced by it is elevated at its circumference very considerably above the level of the surrounding skin, and this raised circumferential portion of the ulcer is distinctly lobulated.

Treatment.—The treatment of Lupus should include hygienic measures, general treatment, and local applications.

Regarding the *hygiene* of Lupus, attention should be paid to diet, climate, and exercise.

The diet should consist chiefly of mutton, beef, or game, either roasted or broiled, well seasoned with condiments, and relieved with a suitable proportion of fresh vegetables, especially of those which belong to the order cruciferæ, *e. g.*, cress, water-cress, radishes, &c. Coffee is a more suitable beverage than tea. A glass or two of wine should be taken every day.

The patient should reside at some part of the sea-coast where the climate is dry and bracing, should be as much as possible in the open air, and should take regular and active exercise.

The *general treament* embraces the use of both internal and external remedies.

The internal remedies employed are cod-liver oil, the preparations of iron, more especially the iodide, iodide of potassium, the liquor arsenicalis, Donovan's solution, the iodide of mercury, quinine, the various bitter infusions, more especially those of gentian, hop, or of the leaves of the walnut-tree, sea-water, &c.

Externally: baths, containing sulphuret of potassium, iodine, carbonate of soda, sea-salt or sea-weed, are made use of.

The *local remedies* are poultices and emollient applications to remove the crusts, huile de Cade, a solution of tannin in glycerine, the tincture of iodine, either alone or mixed with an equal quantity of the linimentum iodine, cashew-nut oil, ointments of iodine, of iodide of potassium or of iodide of lead, creasote-ointment, ointment of iodide of arsenic or of either the green or the red iodide of mercury, chloride of zinc, Vienna paste (equal parts of potash and lime), terchloride of gold, arsenic, sulphate of copper, nitrate of silver in powder or solution, butter of antimony, the actual cautery, carbolic acid, sesquichloride of iron, acid nitrate of mercury, caustic potash, chromic acid, &c.

Within the last few years, however, the treatment of Lupus has been successfully achieved in a comparatively rapid manner, by the process (so-called) of "erasion," namely, by scraping away the friable diseased tissue by means of a small steel spoon, and allowing the raw surface thus produced to granulate healthily. This process, however, is of avail only in dealing with thoroughly diseased areas of skin. The portions of skin in which the Lupus deposit is only scantily disseminated are reserved (after the performance of erasion) for treatment by "multiple scarification," which may be either of the "punctiform" or the "linear" kind.

Keloid.

Synonyms. — Cheloïde; Tubercules durs; Dartre de graisse; Le Crabe; Cancroïde; Cancre blanc; Cancelli; Kelos; Cancroma.

Definition.—Keloid is a small indolent persistent tumor developed in the thickness of the skin. It may be either pale, shining, oval, and flattened, or red, wrinkled, elongated, and prominent.

Causes.—The causes of keloid are very obscure. It is often developed on a cicatrix, but it appears also on perfectly sound skin. It has been known to follow a bruise. It is not hereditary, nor contagious, nor is it connected with any disturbance of the general health, or any specified constitutional condition.

Description.—Keloid is of two kinds, the one spontaneous or oval or "true," and the other cicatricial or cylindrical or "false" Keloid. *Spontaneous Keloid* occurs generally as a single tumor, which is developed usually on the front of the chest about the middle line, crossing the sternum transversely. Its general outline is oval. Its surface flattened, sometimes even slightly depressed towards the centre. Its consistence hard and resisting. It is pretty firmly rooted and immovable. When of long standing it is often extremely tender to the touch. The skin covering it has a tense shining appearance. Its color, generally white, is sometimes pink.

At its margin the tumor gives off a number of filamentous digitations; these subside into the surrounding skin, which becomes somewhat puckered by their gradual contraction. The dimensions of the swelling rarely exceed two or three inches in length by a quarter of an inch in height. Often varicose venous radicles may be seen marbling its surface, and occasionally ligamentous-looking bands may be seen (through the tense skin) crossing the tumor near the surface. Spontaneous Keloid commences as a minute, hard, shining tubercular elevation, which takes several years to attain the size mentioned above. Its development is attended usually with itching, pricking, or even lancinating pain. It has been noticed on various parts of the body, but it occupies generally the chest, arms, or neck. *Cicatricial Keloid* is generally multiple. It presents nothing of the oval outline or flattened shape of the spontaneous variety. It appears as elongated prominent elevations of a semi-cylindrical shape, which bifurcate as they extend. They have some sort of resemblance to the larger divisions of the root of a tree where these appear half above the ground, and this resemblance is increased by the appearance of the skin covering them, which is dry and wrinkled trans-

versely to their length. Their color is a tolerably deep red. This variety is less persistent than the other, and will sometimes disappear spontaneously within a few months after its commencement.

Prognosis.— Spontaneous Keloid once developed is apt to continue ; sometimes, however, although rarely, its color may become altered and the swelling subside, but some traces of it always remain. The cicatricial variety generally disappears completely of itself. The disappearance or diminution of Keloid tumors is effected by interstitial absorption ; they have no tendency to ulceration. Neither variety of Keloid exerts any perceptible influence on the general health.

Diagnosis.—The disease cannot well be mistaken for any other affection.

Treatment. — Chloride of ammonium, cod-liver oil, or the alkaline iodides internally ; ointments of iodine or of various iodides locally. Sometimes stimulating mercurial applications are of service. Severer measures, such as cauterization or excision, are at best useless, for, as a rule, even complete removal or destruction of the Keloid produces only a wound which heals with the formation of a still larger Keloid than before.

Verruca.

Synonyms. — Warts ; Verrues ; Porreaux ; Warze ; Verruca vulgaris ; Thymus ; Myrmecion ; Lophos ; Ficos ; Muron ; Acrochordon ; Acrothymium.

Definition.—Warts are little tumors of the skin varying from the sixteenth to the eighth of an inch in height, which consist of a greater or less number of the natural papillæ of the skin, greatly hypertrophied, embedded in a mass of thickened cuticle.

Causes.—Although sometimes congenital, they may commence at any age. It is far more common, however, for them to appear in children than in adults, and in the former case they are more numerous, although usually of briefer duration than in the latter. Thus, in young children it is not uncommon for a widely-distributed eruption of warts to disappear in the course of a few weeks. It is said that warts are contagious, and that they are more common on the hands of agricultural laborers and other people whose occupation entails the frequent handling of rough substances ; with these statements, however, the author's experience does not accord.

Description.—Warts appear commonly as small tubercular elevations of the color of the surrounding skin, which are somewhat constricted at the base. Their upper surface, which is rather more prominent at the centre than at the sides, is rough, rigid, and nodulated, the nodules being separated by linear depressions, so that the growth has something of the appearance of the head as a cauliflower in miniature. On attempting to detach a portion of a wart by the finger-nail, it is found that its substance may be readily picked off to a certain depth, coming away in the shape of nodules of epidermis, without either pain or bleeding being caused by its removal. If the top of a wart be sliced off, the section exhibits a reticulated marking, which divides the area into a number of polygonal spaces corresponding in size to the nodules seen on the free surface ; in the centre of each of these spaces, if the slice removed be a thick one, is a small bleeding point. The wart so mutilated, if left to itself, soon regains its original size and appearance. The shallow linear depressions which have been referred to as mapping out the surface of the wart into nodules are sometimes extended as fissures deeply into its substance, so as to split it into segments, which may be made to separate temporarily from one another by pinching up between the finger and thumb the portion of skin on which the wart is situated. Sometimes, however, the segments, instead of being parallel and close-set, divaricate, so as to give the wart more of the arrangement of a bunch of carrots (*Verruca digitata*) than of cauliflower-head.

Warts, although their height is pretty constant within the measurements before stated, may vary considerably in area ; this may be so limited that the wart has a pedunculated rather than a sessile appearance, its constricted base giving it the shape of a club ; or the area may be so considerable as to give it the appearance of an elevated patch more than of a tubercle ; sometimes the patch assumes the shape of a wavy band. Warts may appear on any part of the surface, but they are especially frequent on the face, neck, and hands. They are so much less sensitive than the surrounding skin that pressure made on one is felt rather around than beneath the growth.

Prognosis.—Warts are mere disfigurements, which exert no influence of any kind on the general economy, and are not even productive of any local discomfort. As has been already mentioned, they will often disappear spontaneously, and this event is far more probable in the case of a child than of an adult ; but they will sometimes resist cauterization and other severe measures with singular obstinacy, reappearing time after time in their former position shortly after they have been (apparently) destroyed.

Diagnosis.—Verruca may be mistaken for Molluscum or Spilus.

It may however readily be distinguished from *Molluscum contagiosum*, by the latter

being lobulated and marked with a small depression, from which a milky fluid can be expressed; by its having a smooth, polished, and far more sensitive surface, and its being found on section to consist of a thin envelope inclosing a brain-like substance, as well as by its tendency to terminate either by ulceration or sloughing. In *M. noncontagiosum*, if the tubercle be plump, it will present on its smooth, soft surface a hilus, from which a tenacious wax-like matter can be squeezed. If the waxy contents and the hilus be absent, the tumor will be pendulous and flaccid. *Spilus* is always a congenital affection, the elevated spot is soft, is always darker than the surrounding skin, and is often surmounted by a tuft of hard hairs.

Treatment.—This consists either in removing the tubercles by ligature or excision, or in destroying them by means of various caustics.

If the ligature be employed, the little tumor should be pulled forward by means of a hook or forceps, and a thread of silk or a piece of thin silver wire be tightly applied round its base, so as to embrace, if possible, a small portion of the skin; or if excision be practised, the neck of the tumor should be put as before on the stretch, and a small portion of the neighboring skin removed with it. A pair of scissors curved on the flat is the most convenient implement. If cauterization be preferred, the repeated application every other day to the surface of the wart of a glass brush dipped in carbolic, in fuming nitric, hydrochloric, or sulphuric acid, or in a strong solution of chromic or of acetic acid, is the plan to be adopted. It may be necessary to state, that treatment by "erasion" (with a sharp spoon) is practically inapplicable to warts.

Acne.

Synonyms.—The Stonepock; Pimples; Maggot pimples; Grog blossoms; Dartre pustuleuse; Bourgeons; Boutons; Couperose; Finnen; Liebesblümschen; Kupfergesicht; Varus; Gutta rosea; Comedones.

Definition.—The term Acne (ἀκμή, the prime of life, or α priv. κνάω, to itch) comprehends a variety of cutaneous affections, of which the principal phenomenon is either an excess or an alteration in character of the sebaceous secretion of the skin, or an inflamed condition of its sebaceous follicles.

Description.—These affections, although agreeing thus far with one another, yet differ so widely in degree and in appearance that they can scarcely be comprised under one general description. They will therefore be considered separately. They may, however, be conveniently described under two headings; the one including such as are due to an inflamed condition of the sebaceous follicles, and the other such as result from mere excess or alteration in quality of the sebaceous secretion.

Varieties caused by inflammation of the sebaceous follicles:—

Acne simplex begins by little, slightly inflamed, elevated, red points. At the centre of each a small pustule gradually appears of the size of a pin's head, surrounded by a red areola. The areola is not raised. The development of these little pustules is not accompanied by itching or any constitutional disturbance. After the pustule has burst, it leaves a little yellowish crust, which falls in a day or two, leaving a red stain, which slowly disappears. Sometimes the pustule is larger than above described, and its base is somewhat elevated; in such cases it is apt to leave behind it a minute cicatrix.

An eruption of Acne simplex is generally accompanied with a greasy, oily condition of the neighboring skin, and is often associated with A. punctata. It is kept up by a succession of pustules, each of which lasts for about four or five days. It is met with on the face, affecting usually the forehead and temples, on the back between the shoulders, and on the upper part of the chest. It occurs generally in young persons, and has hence been termed Acne juvenilis.

Acne indurata begins by an indurated elevation of a violet-red color, the summit of which soon suppurates. The pustule so formed lasts for several days. The indurated base on which it rests remains for some time after the disappearance of the pustule, and when it has subsided leaves behind it a small cicatrix. Besides these pustules, a number of violet-colored tubercles appear, which in the course of a week or two may acquire the size of a pea, or even of a nut. As they enlarge they soften, and on manipulation it may be felt that their contents are fluid. These little abscesses may either point and discharge a thick curdy pus, or their contents may be reabsorbed. In either case they leave behind them small cicatrices. With this variety are frequently associated A. simplex and A. punctata.

A. indurata is seen more commonly on the face (viz., on the cheeks), and on the back, less commonly on the chest.

Acne rosacea (A. erythematosa) occurs only on the face. It is characterized by chronic erythematous redness, which occurs in irregular-shaped patches, giving the skin a mottled appearance. The color of the patches is in some cases a bright red, in others purplish. This condition is often accompanied with a varicose state of the venous radicles of the skin. In long standing cases the skin sometimes

becomes roughened and rugous and covered with a furfuraceous desquamation. With this variety of Acne A. simplex is often associated, and occasionally other varieties of Acne. Its course is extremely chronic, and it lasts often for many years. It sometimes occasions a feeling of being flushed, and may even be accompanied by considerable tingling.

It is often limited to the nose, but it may affect the forehead, the chin, or the cheeks, or may be extended over the whole of the face. It is confined almost exclusively to persons in middle or advanced life, and is commoner with females than with males. It is temporarily aggravated by mental emotion, by the ingestion of stimulants, by exposure of the face to the sun, to the heat of a fire, or to a sharp wind. It is increased too by indigestion, constipation, and in females by the condition of system that precedes a menstrual period; in fact by everything that tends to congest the face.

In some cases the chronically-congested state of the skin of the nose leads to an irregular hypertrophy of it (*A. hypertrophica*). It becomes studded with red- or violet-colored tubercles of various sizes, which may be either discrete or confluent —may be spread equably over the whole of the surface of the nose so as to enlarge it, sometimes to double its natural size without interfering materially with its shape; or may be developed only on particular parts of it so as completely to transform it.

Varieties caused by an excess of the sebaceous secretion:—

Acne punctata (varus comedo) appears as small black spots imbedded in the skin. The affected surface looks as if a number of grains of gunpowder had been shot into it. If the skin on either side of one of the spots be firmly compressed, a consistent filiform white or yellow substance with a black head to it comes out. This is popularly called a skin-maggot. It consists of the inspissated contents of the dilated sebaceous follicle. Its black head is the result of the action of the atmosphere on the part which the gaping follicle leaves in contact with the air. The larger of these black spots is often surrounded by a small projecting ring of skin —the margin of the orifice of the dilated sebaceous follicle.

Simon (of Berlin) has discovered in these so-called "maggots" an actual epizoon, the *steatozoon folliculorum*. This parasite may be made apparent under the microscope by diluting the sebaceous matter with warm olive-oil.

This variety of Acne is often accompanied with a shining, greasy condition of the neighboring skin. It is seen usually on the face, especially on the forehead and on the alæ of the nose. It is common too on the pinna of the ear, on the back of the shoulders, and on the upper part of the chest. It affects young persons. Its course is generally a chronic one. It may terminate spontaneously, either by the gradual escape of the sebaceous matter from the follicle, which slowly recovers its healthy tone, or by inflammation and suppuration of the follicle and the discharge of the sebaceous "core" in the midst of a small collection of pus.

Acne oleosa.—In this variety the sebaceous matter escapes freely from the follicles in the shape of a shining oily liquid which forms a greasy transparent film over the affected surface. The skin is somewhat redder than natural and has a sodden appearance, and the orifices of the sebaceous follicles are considerably enlarged. This condition of skin is met with usually on some portion of the face, generally the nose or on the scalp, but it occurs also on other parts of the body. When it affects the scalp, the hairs are bathed in a tenacious greasy substance, which towards their roots is of an oily consistence, but gets gradually more and more tenacious towards their tips so as to mat them together. This variety of Acne is often associated with A. punctata, A. indurata, or A. simplex. It affects young persons, and follows a chronic course.

Acne cerea.—In this variety the sebaceous exudation, instead of forming an oily film on the surface, concretes into a solid crust, which at first is soft, light-colored, and easily detached; but afterwards gets harder, darker-colored, and more adherent. On detaching the crust with the finger-nail, its under surface may sometimes be seen to be studded with little, short, white filiform projections, which are the contents of the sebaceous follicles which have been removed with it. It may be observed that it breaks with a waxy fracture, and that it is readily kneadable into various shapes —a character which at once distinguishes it from other cutaneous exudations. The surface laid bare by its removal is somewhat reddened, and the orifices of the sebaceous follicles are enlarged and gaping. The skin has sometimes, too, a sodden and unctuous appearance. It soon covers itself with a fresh crust. When the crust is hard and has lasted for some time, the subjacent skin has often a somewhat cicatricial appearance. This is generally associated with some other variety of Acne. It is situated generally on the face, but is not uncommon on the scalp, where it occurs as thin, dirty, gray crusts, which are apt to occasion more or less baldness. It is met with at all ages. It follows a chronic course.

Acne cornea is rarer than the preceding. It appears in the form of yellow, gray, or dark-brown conical or cylindrical projec-

tions, which are of a horny consistence. By compressing the skin at their base, they may often be expelled, so that it may be clearly seen that they are rooted in the orifices of dilated sebaceous follicles. This condition the author has seen associated with Ichthyosis cornea. It occurs on all parts of the body.

Causes.—*Acne simplex* is most commonly met with in young persons of either sex at about the age of puberty. *A. indurata* is also common with young persons, and is rare after the age of thirty. It has been ascribed to onanism; but the robust, healthy, and vigorous appearance of the majority of those who are affected by it is by no means in accordance with such a supposition. This variety, as well as the *oily*, *waxy*, and *horny* varieties of Acne, may with greater propriety be referred to the influence of temperament as being affections that are almost constantly associated with the lymphatic temperament. In persons of this constitution the skin is comparatively thick, pale, opaque, sluggish, and greasy; in fact, exhibits in a moderate degree many of the characteristics that it presents in persons affected with these varieties of Acne. *A. rosacea*, which occurs usually in people of sanguine temperament, is an affection of middle age. It is occasioned and kept up by the various causes (already detailed) by which repeated flushing of the face is induced. It is commoner with females than males.

Duration.—Acne is a chronic affection, lasting usually for months or years.

Diagnosis.—*Acne simplex* may be mistaken for Ecthyma or Impetigo, but the pustules of Ecthyma are much larger and flatter and are surrounded with a broader areola. In Impetigo the pustules are confluent, and the raw surface left by their rupture exudes a plastic sero-purulent liquid, which concretes and forms thick crusts.

A. indurata is apt to be mistaken for Syphilis, more especially for "syphilitic Acne" and for "syphilitic Lichen;" but the pustules of the syphilitic affection may be distinguished from those of Acne by their situation, which embraces the limbs as well as the face and trunk; by the coppery color assumed by their bases as they fade, and the coexistence of other symptoms of constitutional Syphilis. The small tubercles of the papular syphilide are to be known from those of Acne by similar tests as well as by the nature of their contents.

A. rosacea when it is attended with desquamation may be confounded with Eczema or with Pityriasis, but in Eczema itching is a more prominent symptom; there is more desquamation and the surface is moister, the eruption moreover is rarely confined to the face. In Pityriasis of the face the affected skin has a tawny-red rather than a purplish-red hue, and there is no enlargement of the venous radicles of the skin; the desquamation, too, is more abundant.

A. tuberculata may resemble "syphilitic Lupus," or scrofulous Lupus, but the tubercles of the syphilide are more translucent, their surface smoother, and the orifices of the sebaceous follicles are not enlarged. The diseased skin has a tendency to ulcerate and become covered with a thick crust, on detaching which a ragged deep ulcer is laid bare. The scrofulous tubercles may also readily be distinguished from those of A. tuberculata by their tendency to ulcerate and become covered with a crust which conceals an ulcer.

The secretion of *A. oleosa* is to be distinguished from ordinary sweat by its shining surface and oily consistence.

The crusts of *A. cerea* may be distinguished from those of Impetigo by their greasy nature and their malleability.

Treatment.—In Acne simplex, when the pustules are surrounded by deep red, somewhat elevated areolæ, and the patient is of sanguine temperament, the administration of saline laxatives will be requisite; the diet should be moderate in quantity and of an unstimulating kind; vapor-baths or the vapor-douche should be employed in the first instance and afterwards weak spirituous lotions. When the inflammatory character of the rash has subsided, a dilute solution of corrosive sublimate (gr. j or ij, ad ℥j) applied tepid will complete the treatment. When the eruption occurs in females at the age of puberty in whom the menstrual function is imperfectly established, aloetic purgatives and warm hip-baths will be proper.

In Acne indurata, if the pustules be small, the frequent application of the tepid sublimate solution will sometimes suffice; but in the majority of cases more stimulating applications will be required, such as sulphur ointment (℥j to ℥ss of sulphur to ℥j of simple ointment); ointment made with precipitated sulphur is preferable to that made with sublimed sulphur. Ointment of the iodide of sulphur (a favorite remedy) may be used, if preferred. If the pustules be large and interspersed with livid suppurating tubercles more decidedly stimulating applications will be called for. One of the most convenient is an ointment of the red iodide of mercury (gr. v, xxx to ℥j); the application of this should be continued until the surface has become moderately inflamed, and in a few days' time, when the inflammation has subsided and the effect of the ointment can be judged of, its use should be resumed if necessary, and so on until the eruption has completely disappeared. In such cases recovery will be greatly hastened by opening

the larger of the tubercles with the point of a lancet and expressing their curdy contents. An ointment of chrysophanic acid containing twenty per cent. of the acid is a valuable remedy in Acne indurata, special care being of course taken to keep the ointment away from the eyes.

Most cases of this variety of Acne are associated with an habitually constipated condition of the bowels; when this is the case moderate but regular purgation materially aids the local remedies in subduing the eruption.

In many cases indurated Acne is associated with manifest indications of a scrofulous constitution; such cases are benefited by moderate doses of cod-liver oil with some chalybeate.

In Acne rosacea attention must be directed chiefly to the internal disorder on which the eruption depends. If there be any disturbance of the uterine function this will require to be corrected. When, as usually happens, the digestion is disordered, it will be necessary to rectify it; tonics should be given, the diet should be selected, and the bowels regularly acted upon if necessary. If the patient be of sedentary habits, regular and active exercise should be enjoined. In some cases, even amongst ladies of good position, habitual intemperance is the cause of the eruption. In such cases very little progress can be made unless the habits of the patient can be controlled.

The local treatment of Acne rosacea should consist in the application of astringents and moderately stimulating substances, such as tepid eau-de-cologne and water, camphor-cerate or weak tepid lotions of corrosive sublimate, of the acetate of lead, or of tannin. When there is much thickening of the skin stronger remedies are demanded, such as those already mentioned as suited to the indurated variety.

In Acne hypertrophica, when the eruption appears to result from free living, the diet should be moderate and simple. Saline purgatives with steel and aromatics should be prescribed and regular exercise be enjoined. Any of the tubercles that appear to be suppurating should be pricked with a lancet, and any distended and gaping sebaceous follicles should have their contents squeezed out. When the hypertrophy of the skin is not very considerable, moderately stimulating applications, such as sulphur ointment, will suffice, but when the skin is greatly thickened, such stimulation as for example is effected by a red iodide of mercury ointment is requisite to anything like speedy recovery.

In Acne punctata, when the gaping follicles are not very numerous, their contents should be squeezed out and some stimulant or astringent application be made to them, such as a strong solution of sulphate of zinc or of alum, or a little undiluted eau-de-cologne; but when the punctate eruption is copious other means must be had recourse to for unloading the follicles of their accumulated secretion. Bathing the affected surface with aromatic vinegar or with a dilute solution of potash or with benzine, favors the expulsion of the sebaceous matter. Gentle friction of the surface with a smooth piece of pumice-stone does so too. The vapor-bath and the vapor-douche have the effect of softening the inspissated secretion. But however much the *contents* of the follicles may be acted on, whether by chemical or mechanical means, the over-distended follicles, having lost all contractile power, are unequal to the task of expelling their secretion. The only effectual way of compressing them when they are at all numerous is by exciting such a degree of inflammation in the skin as shall produce palpable swelling, and then the distended substance of the skin, exerting an equally diffused and sustained pressure on the over-gorged follicles, will completely empty them of their contents. For this purpose various stimulants may be employed, moderately strong creasote ointment, a mixture of croton with olive-oil, cantharides ointment, &c. When the follicles have been thus unloaded they should be encouraged to contract to their normal calibre by the daily application of some mildly stimulating or astringent substance. At the same time general measures adapted to give tonicity to the skin should be adopted, such as chalybeates, occasional laxatives, and the regular use of the cold bath.

In Acne oleosa the use of astringent lotions has been recommended, but the persistently greasy condition of the surface prevents them from coming into actual contact with the skin. It is therefore necessary to wash off the oily film by means of benzine each time before they are applied. Solutions either of tannin, alum, sulphate of zinc, or acetate of lead, may be used, but mixtures of creasote with oil, or of a small proportion of hepar sulphuris with soft soap, are preferable applications.

In Acne cerea the crusts should first be washed off by means of soft soap, and then sulphur ointment should be used.

Molluscum.

Synonyms.—Elevures folliculeuses; Mycosis fungoides; Acne molluscum; Lupra; Acne varioliformis; Ecdermoptis.

Definition.—Molluscum (Mollusca, a nut with a soft shell) is a chronic disease of the skin characterized by more or less numerous sebaceous tumors varying from

the size of a hemp-seed to that of a hazelnut, rarely larger, either prominent or flattened, sessile or pedunculated, usually of the color of the skin, but sometimes tinged with pink or with brown, marked generally with a hilus, and containing atheromatous matter which may be squeezed out through the hilus. There are two varieties of the disease, the non-contagious and the contagious.

Causes.—(Of M. contagiosum), childhood, contagion; (of M. non-contagiosum), the wearing flannel next the skin, neglect of ablution, middle or advanced life.

Description.—*M. non-contagiosum* appears on various parts of the surface in the form of minute indolent tumors, which augment very slowly in size. These are usually somewhat constricted at the base; the neck either may be thick and short, so that the little tumor is sessile, or may be narrow and long, so as to make it pedunculated and pear-shaped. (M. pendulum): some of the tubercles are rounded, plump, and of a pretty firm consistence, others are withered, flattened, and flabby. The surface has usually all the appearance of healthy skin, sometimes however it is slightly tinged with brown. In those that are plump the skin appears a little stretched, in those that are flabby it is thrown into folds, and has a relaxed and wrinkled appearance. There is usually to be found at some part of the tumor, generally near the centre, but sometimes on one side, a small cœcal depression. This is more obvious in those that are plump than in those that are flaccid; in some of the former it is not cœcal, but, though plugged up by a small comedo, communicates freely with the interior of the tubercle, and on compressing the little tumor a long, thin, white worm of inspissated sebaceous matter may be forced out through it. On section of one of the plump tubercles it is seen to consist of a fibro-cellular envelope containing an atheromatous substance. On incising a flabby one it is found to be merely a small pouch of redundant skin inclosing a little cellular tissue. The plump and sessile tumors are an early stage of the pedunculated and flabby ones, and are hypertrophied sebaceous follicles. There may be only one or two, or there may be a great many; they do not give rise to any sensation, neither are they at all tender to pressure, nor do they in any way affect the general health. They are more common on the trunk than elsewhere, and in the middle-aged and elderly than in young persons or children. They have no tendency to terminate spontaneously.[1]

M. contagiosum, although resembling the preceding variety in general appearance, yet differs from it in many important particulars. Thus it is commoner in infants and young persons than in the aged; it is, as its name expresses, contagious; it is commoner on the head, neck, and limbs than on the trunk; the tubercles are of quicker growth and their contents are of a different character. The little tumors, which are hard, globular, and sessile, having a constricted base, vary in size from that of a large pin's head to that of a pea or more; their surface is smooth and shining; their color is either the natural color of the skin or slightly redder, and they are usually semi-transparent. They present in the centre or at one side a small gray or black depression, from which five or six linear indentations radiate, dividing the mass into imperfect lobules, and giving it the appearance of a tomato or a rock-melon. On compressing the tumor laterally a small quantity of a milky fluid may be made to spurt out from the depression on its surface, but the bulk of its contents remains within unless the tumor be burst across by the pressure; if this happens a lobulated, glistening, white brain-like mass of nearly the size of the tumor itself is enucleated, and the thin membranous envelope is all that remains attached to the skin. The tubercles are of slow growth, taking several months to attain the size of a pea; they are developed without pain or itching; after attaining a variable size they may terminate spontaneously; the little tumor either is destroyed by suppuration, or becoming strangulated as it increases in size, sloughs off; whichever happens a small sore is left which soon cicatrizes. The affection may consist of only a very few scattered tubercles confined to a limited region, or it may be constituted by a great many of them extensively spread and thickly strewn. The tubercles are not developed all together or even in crops, but follow one another in irregular succession, so that at any given time different tubercles will be seen in different stages. Their favorite situation is the face; especially the forehead, but they appear too on the scalp, the breasts, the limbs, and the genitals, and less commonly on the trunk itself. They are distended sebaceous follicles. Their contagiousness has been denied by some authors of repute, and held in doubt by others; the author has however met with cases where he has been enabled to trace the introduction of the disease into families, and its spread through them, so clearly to contact with

[1 Under the name "fungoid cutaneous neoplasm," Hebra and Duhring have described tumors which, although not identical with molluscum, yet present some analogy to it. See the Archives of Dermatology, New York, October, 1878.—H.]

affected persons, as to allow of no doubt, at least in his own mind, of its contagious character.

Prognosis.—By neither of the varieties of Molluscum is the general health in any way affected. In the non-contagious variety the tubercles, having attained a certain development, become stationary and continue indefinitely. In the contagious kind, however, they may terminate spontaneously either by suppurative inflammation or by gangrene. In either kind under suitable treatment speedy recovery may be obtained.

Diagnosis.—The constricted base, the indolent character, and the chronic course of these little tumors; the nature of their contents, and the presence of a hilus on their surface, suffice to distinguish them from any other elevations on the skin.

Treatment.—In M. non-contagiosum if the tubercles are plump, firm, and of but small size, their sebaceous contents should be pressed out, the orifice having been enlarged if necessary with a lancet; after this the ung. hyd. iod. rub. should be applied once or twice so as to cause inflammation of the enlarged follicle. In other cases the little excrescences should be snipped off with a pair of curved scissors.

If M. contagiosum has appeared in a family or a school, care should be taken to isolate the children that are affected from the rest, until the disease has disappeared. When the tumors are few, each of them should be incised with a lancet, and their contents enucleated by gentle pressure, the spots should then be touched with nitrate of silver. When from the number of the tubercles this mode of treating them is inconvenient, the application of some ointment that is at once stimulating and calculated to destroy a vegetable parasite should be had recourse to; the unguentum iodi compositum, or an ointment of the green iodide of mercury (gr. x ad ℥j) are suitable applications for the purpose.

SECTION VIII.—MACULÆ.

The Macular diseases of the skin are Nævus, Lentigo, Ephelis, and Vitiligo.

NÆVUS.

Synonyms.—Mother's Mark; Envie; Muttermaal; Maculæ maternæ; Ligna, Nævus sigillum.

Definition.—A Nævus, in the sense in which the term is understood here, may be defined as a congenital permanent discoloration of the skin, in some cases with, in others without, elevation beyond the surface of the normal skin.

Causes.—Nothing is known as to the determining causes of these malformations. They are popularly supposed to be occasioned by the longings of the mother during the time of her pregnancy for various delicacies which are thought to bear some sort of resemblance to the stains, *e. g.*, for claret, port-wine, or slices of ham; or to result from her having been startled by some object of aversion which resembles the mark, *e. g.*, a toad or a mouse.

Description.—Nævi are of two kinds, the pigmentary and the vascular.

The *pigmentary Nævi*, or Moles, (or Spili,[1]) occur usually as small rounded stains, which may vary in color from a faint tawny yellow to a dark brown. The cutis is sometimes raised and thickened, and the discolored spot is often surmounted by a tuft of hairs. In some cases the Spilus, in place of being small and rounded, is extensive and of irregular shape. The discoloration of the skin is due to an excessive (local) development of the pigmentary matter of the cuticle. When the mole is raised the elevation is due to simple hypertrophy of the cutis. The hairless moles are popularly known as toad-marks. Those that are surmounted by hairs are called mouse-marks or mole-marks.

There may be very few of them, or they may be very numerous.

The situations in which they most commonly present themselves are the face, the neck, and the hands.

In some rare cases the greater part of the body may be covered with an extensive hairy mole, so that the individual, when stripped, looks more like a monkey than a man.

Vascular Nævi appear either in the form of stains, which are level with the surface of the skin, or as tumors, which project beyond it. In the one case they are merely cutaneous, in the other they are more deeply rooted, and do not always involve the skin. The former kind results from an excessive development of the capillaries of the skin, while the latter may be due to a congeries of dilated arteries, capillaries, or veins.

It is the former kind only—the port-wine stain, as it is popularly called—that will be considered here.

The "port-wine mark" occurs usually in the form of purplish stains. The tint of these, however, in different cases varies considerably; thus they may approach a brick-red, a claret-red, or a livid, blue color. Sometimes the stains are extremely small, presenting merely the appearance of a red dot with minute branching lines radiating from it (Nævus araneus, or spider-mark), but often they are extensively spread. When of large extent their shape is very irregular.

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1 σπίλος, a stain.

They may occupy any part of the surface, but are seen most commonly on the face and neck. They are quite superficial. Their color, which disappears almost completely under the pressure of the finger, varies in intensity under the influence of such causes as augment or diminish the capillary circulation.

Diagnosis.—Both kinds of Nævus are such familiar and peculiar objects that they can scarcely be confounded with any other lesion of the skin.

Prognosis. — The pigmentary Nævi usually last for life without undergoing any sensible change; in some cases, however, they gradually become less distinct. Vascular Nævi also remain in most cases without change during the whole of life. Some, indeed, soon after birth become decidedly paler, while others in the course of a few weeks altogether disappear; but those which continue unaltered for the first few months rarely undergo any subsequent change.

Treatment.—Both moles and port-wine marks are considered by the majority of writers as incurable; that is to say, all the means which they have employed with any success for the removal of the stains have always left a scar more disfiguring than the stain itself. If anything be attempted, the cautious application of caustics, or if there be much elevation of the stain and its area be very limited, the application of a ligature are the remedies suitable to moles.

Frictions with croton-oil or with tartar-emetic ointment, the application of blisters, the use of caustics, or (in an unvaccinated person) inoculation of the patch with vaccine matter, are means of attacking the port-wine marks.

A better method, however, of dealing with port-wine marks is to scarify the affected skin with numerous parallel linear incisions, arresting the bleeding by pressure and repeating the process when (after three or four days) the previous scarifications have healed; at each successive scarification the direction of the parallel incisions should be veered, so that they may decussate with the previous set of scarifications. Some ten or a dozen repetitions of the operation are requisite.

Lentigo.

Synonyms. — Pannus lenticularis; Taches de rousseur; Lenticula. Freckles.

Definition.—A yellowish discoloration of the skin, the result of a lesion of the pigmentary secretion, congenital or acquired, occurring in the form of numerous minute spots, discrete or confluent, occupying the exposed parts of the surface.

Causes.—Congenital formation, youth, the lymphatic temperament, a fair complexion, exposure to the rays of the sun.

Description.—Lentigo occurs in the form of numerous minute, rounded, yellowish stains, the size of mustard- or lentil-seeds.

The tint of these varies a little; thus their color may be a bright (saffron) yellow, a duller (tawny) yellow, a warmer (reddish) yellow, or a brownish yellow: in the last case the stains look like scales of bran sprinkled on the skin.

The spots may be either discrete and scattered pretty equably over the region occupied by them, or clustered and more or less confluent. They occupy most commonly the face and (to a less extent the) hands, but in persons of out-door occupation, whose chest and arms are habitually bare, *e. g.*, agricultural laborers or sailors, freckles are common on the forearms and upper part of the chest.

They are congenital, or appear during childhood.

They are found generally in persons of fair complexion and lymphatic temperament, but especially in those who have auburn or red hair and *very white* skins, so that they appear to be produced by an unequal distribution rather than an excessive development of the pigmentary matter of the skin.

Freckles are not accompanied by itching or any other sensation, nor is there either elevation or desquamation of the discolored surface.

Spots which in no degree differ from congenital or infantile freckles are produced in certain persons on exposure to the sun's light, and appear only in summer. Those who are permanently freckled are especially liable to these ephemeral freckles, so that the freckling appears intensified during the summer.

Diagnosis.—Lentigo may be mistaken for Ephelis, pigmentary Nævus, Chloasma, Macular syphilide, or the stains left by syphilitic Lichen.

But in Ephelis the patches are much larger than in Lentigo.

Pigmentary Nævi are never so numerous as freckles; their shape is more irregular, and they are of larger size.

From Chloasma, Macular syphilide, and the stains that succeed to syphilitic Lichen, Lentigo, may be distinguished by the same signs as Ephelis.

Prognosis.—The congenital or infantile stains may last for life, but they often disappear during adolescence. Those which are caused by the rays of the sun generally disappear when their cause ceases to operate. This latter kind, although as regards appearance they are essentially lentigines, are in their nature more closely allied to Ephelis than to the congenital Lentigo.

Treatment.—For the congenital freckles nothing can be done, but for those which are caused by the rays of the sun the same measures are appropriate as for patches of Ephelis of similar origin.

Ephelis.

Synonyms.—Pannus hepaticus; Taches hepatiques; Lebersflecke; Sommerslecke; Tawny blotches; Macula solaris.

Definition.—A yellowish-brown discoloration of the skin, the result of a lesion of the pigmentary secretion, occurring in moderately sized patches.

Causes (predisposing).—Adult age, the female sex, a delicate skin.

(Exciting).—Exposure to the sun, the menstrual period, pregnancy.

Description.—Ephelis occurs in the form of yellowish-brown rhubarb-colored stains. These stains at their first appearance may be no larger than a threepenny-piece, but they usually extend in a variable degree so as often to acquire the size of a crown-piece. As they increase in area their margin, which at first is tolerably regular, becomes more or less uneven.

The disease consists simply in a change of the *color* of the skin without any induration or thickening of its substance or any desquamation of the cuticle. It produces no appreciable disturbance of the general health, nor is it usually attended with any local sensation. In some cases, however, there is slight itching of the discolored skin. The color of the stains does not vary much, but they occasionally exhibit somewhat more of a warm yellow, or, on the other hand, more of a cold gray tinge, than is implied by the description "rhubarb-colored."

The stains are not congenital, and do not often appear before adult age has been attained; they occur usually on some part of the patient's fore-surface, but are far commoner on the face than in any other situation. In females they frequently appear soon after the commencement of pregnancy, disappearing shortly after delivery. In such cases the stains usually affect the forehead chiefly, and to a less extent the cheeks and upper lip. In some women they appear at the menstrual periods, disappearing during the intervals.

The occurrence of Ephelis may often be traced, however, in either sex to prolonged exposure to the rays of the sun in hot weather. When thus produced, the disease commonly appears on the forehead, but amongst the agricultural laborers who work with the chest and arms uncovered, it often affects the upper part of the breast, the forearms, and the hands. When due to solar influence, Ephelis will generally fade and often disappear altogether during the winter months.

Diagnosis.—Ephelis may be mistaken for pigmentary Nævus, for Chloasma, for Macular syphilide, and for the stains which succeed to syphilitic eruptions on various parts of the body, or which follow chronic Eczema of the legs. But pigmentary Nævus is always congenital.

In *Chloasma* there is branny desquamation of the cuticle, and the spores of the microsporon furfur may be detected by means of the microscope in the epithelial scurf; the eruption too is attended with considerable itching, and is situated generally on the front of the chest, whereas Ephelis is more common on the face.

Macular syphilide is rare; its stains are of a deeper color than those of Ephelis, and are usually accompanied with other symptoms of Syphilis.

The tawny stains which are left by syphilitic eruptions or by Eczema of the legs, may be distinguished by their having more of a chocolate and less of a rhubarb tinge, and by the history of an eruption having preceded them.

Prognosis.—The stains sometimes disappear with the cause (uterine or solar) which has given rise to them, but they are often chronic, they exert no influence on the general health.

Treatment.—If there be any derangement of the uterine function this should be corrected. If, however, sunlight appears to be the cause of the discolorations, exposure to the sun should be avoided, or at all events a veil or shade of some sort should be worn.

As internal remedies, the various sulphurous mineral waters, the Vichy water, or potash water, and mild laxatives, have been prescribed.

As local remedies, benzoin fumigations, ointment of the sulphuret of mercury (gr. x to ʒj); lotions of corrosive sublimate (gr. j to ʒj); of sulphuret of potassium (gr. xij to ʒj); of sulphate of zinc, or acetate of lead (gr. viij to ʒj), or of the two mixed together so as to form a solution of acetate of zinc; warm douches of sulphurous mineral-water; the emulsion of bitter-almonds; weak spirituous lotions; lotions of the dilute mineral acids or of liquor potassæ (ʒss to ʒj), or of Goulard's extract (♏ x to ʒj); chlorine-water; ointments of the subcarbonate of potash or of soda (ʒj to ʒj); Oxymel—are the remedies most employed.

Vitiligo.

Synonyms.—Leucoderma; Achroma; Epelis alba; Macula alba: Macula albida; Alphoderma; Leucopathia.

Definition.—A milky-white discoloration of the skin (the result of a lesion of the pigmentary secretion), congenital or acquired, occurring in the form of rounded patches of variable size.

Causes.—Nothing at present is known of the causation of Vitiligo.

Description.—Vitiligo occurs in the form of more or less extensive, rounded (oval or circular) patches of blanched skin; the patches commence as small white dots, which very slowly increase in size. The

disease consists simply in an alteration of the *color* of the skin without any modification of its substance or alteration of its surface, the skin remains as thin, as supple, and as smooth as usual: but has over a limited area exchanged its natural color for a dead-white appearance. If there be hairs on the patches they will be white also. The skin immediately surrounding each of these white patches is of a dusky-brown hue, and in proportion as the white patches get larger the skin around them becomes more deeply tinged with brown. So that the disease seems to consist rather in an unequal distribution than in an absence of the natural pigmentary constituent of the cuticle. The whiteness of the patches ceases abruptly, so that their margins, whether rounded or sinuous, are always clearly defined, and they are rendered still more conspicuous by the more than naturally dark skin that surrounds them. The dark areola which surrounds the white patch, although it ceases abruptly at its inner margin, yet at its outer border fades insensibly into the natural color of the skin. The coloring matter is not always collected equally and uniformly around the blanched spaces; at one part of their circumference it may form a black patch, white at another point the areola may be altogether wanting. Vitiligo occurs on all parts of the body, but especially on the uncovered parts (face, neck, and hands), and on the hairy parts of the body (for instance, the scalp, the axillæ, and the pubes). It is a comparatively rare disease. It is commoner among the dark than among the fair races of mankind. In the negro it constitutes what is known as the piebald negro. Its course is always very slow and gradual.

Prognosis.—When congenital it is not likely ever to disappear; when acquired it occasionally disappears spontaneously, after which it may sometimes gradually reappear.

Diagnosis.—Vitiligo is likely to be confounded with Addison's disease, but in the latter there are no definite patches whiter than the natural color of the skin. There are dusky-brown patches, but these are diffused and their margins are in all directions gradually lost in the natural color of the unaffected skin. There are no concave, well-defined margins to any part of the stains. The discoloration of the skin is, in Addison's disease, attended with marked deterioration of the general health. In Vitiligo not so. Again, while the latter is the effect of an unequal distribution of the pigment of the cuticle without alteration of its quantity, so that part of the skin is darker, part lighter, than natural, the former is characterized by an excessive development of the pigment of the skin, so that parts of the surface are darker but none lighter than is proper to the individual in health.

Treatment.—No remedies are known which are of any efficacy in the treatment of Vitiligo.

SECTION IX.—SYPHILIDA.

Synonyms.—Syphilides; Syphilitic eruptions; the Secondaries; the Venereal disease; the French disease; Le mal anglais; Le gros mal; Le mulet épidémique; La vérole; La grande vérole; La gomme; Die Lustseuche; Venerische krankheit; Lues venerea; Morbus fœdus; Morbus venereus; Lues syphilitica; Pudendagra.

Definition.—The term "Syphilide" comprises all diseases of the skin that are developed under the influence of syphilitic infection, excepting the primary syphilitic ulcer or chancre.

Causes.—The only causes are contagion and hereditary transmission.

General description.—Although differing considerably from one another not only in aspect, but in situation, course, and many other details, the Syphilides have nevertheless certain characters in common which distinguish them as a class from other diseases of the skin.

The *color* of the Syphilides is peculiar; it has been compared by some to that of metallic copper, by others to that of the lean part of a ham; for this tint to be present it is not necessary that the surface should continue unbroken; thus it may not only be present in exanthematous, papular, and tubercular Syphilides, but may be seen also around the edges of syphilitic pustules, blebs, and ulcers.

The *shape* of the eruption is frequently annular; thus it may form complete circles or ellipses or these may be incomplete, so that a patch may assume a crescentic or a horseshoe shape, or two complete rings may be in juxtaposition so that a figure-of-8 be formed, or two incomplete rings may become fused so as to resemble the letter S or the letter E.

A Syphilide is rarely attended with itching or smarting.

The often *mixed character* of a syphilitic eruption—that is, the coexistence of several distinct varieties of Syphilide—is another means of recognizing its nature; thus syphilitic rashes, scales, papules, and pustules may occur together on the same individual.

The secondary products, such as the scales, the crusts, the ulcers, and the scars of a Syphilide, have characters which distinguish them from those of a "simple" cutaneous disease. *The scales* of a squamous Syphilide are scantier, finer, smaller, and more adherent to the surface beneath than those of a simple squamous affection. *The crusts* left by a bullous or an ulcerating tubercular Syphilide are much thicker and harder and are more

firmly adherent than the crusts of a simple eruption; they are usually of a dark green color; their surface, which is raised at the centre, is often marked by a series of concentric rings showing a stratified arrangement of their substance, and may be dotted here and there with little nodular projections, so that the crusts may bear a pretty close resemblance to limpet-shells. *The ulcers* that are produced by a Syphilide are generally circular and have clean-cut perpendicular edges and gray pultaceous floors; their margins, as before mentioned, are of a coppery hue. *The cicatrices* left by the ulcers retain for some time the tawny-brown hue of the eruption that has preceded them; after this has faded they may often still be recognized by their preserving the traces of an annular or a crescentic arrangement.

No one, however, of the characters above detailed is pathognomonic of a Syphilide.

If, for example, the tawny hue of an eruption be regarded as an absolute proof of its syphilitic origin, simple Psoriasis would at once be brought under the category of the Syphilides; on the other hand, the absence of this hue cannot be regarded as positive evidence of the simple nature of an eruption, since many of the Syphilides at their commencement do not at all exhibit it, but are of a bright rosy-red color, assuming the tawny tint only as they are beginning to fade.

The annular arrangement, too, is by no means *peculiar* to eruptions of syphilitic origin, since it is found also in Lichen, Lupus, Psoriasis, and Herpes circinatus; nor is it even a constant symptom of syphilitic cutaneous disease—it is wanting in syphilitic Acne, syphilitic Lichen, and in mucous tubercles.

Again, itching and smarting are not always completely absent from a syphilitic eruption and are alike rare in (scrofulous) Lupus.

Nor is it an invariable rule that one variety of cutaneous Syphilis should be accompanied by some other; for instance, syphilitic Roseola often occurs singly; so do mucous tubercles.

In like manner exception may be taken to any one of the secondary products of cutaneous Syphilis being considered as constituting by its presence or absence a pathognomonic or absolutely distinctive sign of the syphilitic or non-syphilitic nature of an eruption. But enough has been said to show that each of the phenomena enumerated above as generic features of the Syphilida may in its turn be either altogether wanting or but faintly apparent, and that there is no single characteristic of cutaneous Syphilis which taken separately may not be more or less simulated by non-syphilitic eruptions.

In determining whether a disease of the skin be syphilitic or not, much assistance is to be derived from a knowledge of other changes produced by syphilis besides those wrought in the skin itself: *redness of the fauces, opaline infiltration (in patches) of the mucous membrane* of the cheeks, fauces, posterior surface of the pharynx, uvula, tonsils, palate, tongue, or gums; or ulcers in the same situations.

Chronic laryngitis.—Indicated by a husky whispering quality of the voice.

Mucous tubercles (often complicated with deep fissures) at the angles of the mouth, at the nostrils, the arms, and the vulva, or the prepuce and scrotum; or condylomata, or cauliflower-excrescences of anus, vulva, or prepuce.

Neuralgia affecting both sides of the head over the frontal and parietal regions.

Rheumatic or *osteocopic pains* (as they are termed) felt along the bones and in the joints of the limbs, becoming worse at night-time. *Thinning of the hair* of the scalp and face, sometimes in a very considerable degree.

Periosteal swellings, exostoses, caries of the bones of the cranium or face, *circumscribed indurations of the subcutaneous cellular tissue, syphilitic iritis*, the *syphilitic cachexia*, &c.

The various forms of syphilitic cutaneous disease may be arranged in eight groups, as follows:—

Vegetative, exanthematous, vesicular, squamous, papular, pustular, bullous, and tubercular Syphilides.

Some of the Syphilides appear soon, some late after the occurrence of syphilitic infection. In other words, some may be spoken of as the earlier and some as the later manifestations of the syphilitic diathesis. To the former the name of "secondary," to the latter that of "tertiary Syphilides" has been given. It would be unwise to abolish these distinctions (although it must be admitted that sometimes the so-called "tertiary" appear soon, and the "secondary" late after syphilitic infection) provided that no more than a just significance be attached to them; that the term "secondary Syphilide" be held to mean only a "species of syphilitic eruption which is not usually associated with depreciation of the general health, does not occasion any notable destruction of the skin, and which when it occurs generally makes its appearance soon after the acquirement of the syphilitic diathesis," and that a converse meaning be attached to the term "tertiary Syphilide."

With this understanding it may be said in general terms that the vegetative, exanthematous, vesicular, squamous, and papular Syphilides belong to the "secondary," and that the pustular, bullous, and tubercular Syphilides compose the "tertiary" division.

Varieties of Syphilitic Cutaneous Disease.

Vegetative Syphilides.—These are among the commoner of the manifestations of constitutional Syphilis, and are developed often within a few weeks after syphilitic infection. But although they may fairly claim to be classed among the secondary symptoms of Syphilis, inasmuch as they may make their first appearance many weeks after infection, and in situations remote from the point of inoculation, they differ from all the other secondary symptoms of Syphilis in being endowed with the capacity of playing also the part of primary Syphilis; they share with the chancre the property of transmitting syphilitic infection.

The vegetative Syphilide is of two kinds, the flat and the prominent.

The *flat variety*, known under the name of "mucous tubercle," or "mucous patch," commences as a small rounded, slightly-elevated, rose-red patch, which soon becomes excoriated. The raw surface thus produced, which may be either of a bright pink or an ash-gray color, is composed of numerous moist flattened granulations, which are marked out by very shallow linear depressions. It presents such an appearance as would be produced if an extremely fine net were drawn tightly over a slightly convex surface of moist mucous membrane, so that the pulpy substance of the mucous membrane might be forced to bulge a little through the meshes of the net. The appearance of the surface does not convey the impression of an open sore, the granulations, if they may be called so, are too regular in their arrangement, too flat and too tough (not bleeding when they are rubbed); they appear to be protected by a tolerably tough opalescent membrane, the surface of which has a moist glistening appearance. Altogether the term "mucous patch" is a very apt one.

The outline of the mucous patch is usually regularly circular or oval.

Its size ranges from that of a sixpenny-piece to that of a florin.

Its surface, which is generally slightly convex, may at its circumference be even with the level of the surrounding skin. But usually the edge of a fully-developed patch is raised a line or two above the level of the sound skin, so that the raised patch is abruptly limited, its margin being connected with the lower level of the sound skin by a wall of tense, thin, dusky-red skin. Sometimes the surface of the mucous patch is sprawled out, so that its everted margin overlaps the distended ring of skin which limits its root. The mucous patch then presents a really "vegetative" appearance; this is the form that it ordinarily assumes.

When the mucous patch occupies an exposed situation (*e. g.*, the cheek) the liquid secreted from its surface dries up into a tolerably thick yellowish crust, on detaching which the mucous tubercule is disclosed exhibiting its special appearance. But when, as more commonly happens, a mucous patch is in a cleft (as it is when developed on the margin of the anus), so that its surface is in contact with an opposed surface of skin, no crust is formed, but an abundant viscid, fetid, irritating mucous discharge exudes from the patch, causing much redness and itching of the surrounding skin.

Mucous patches are almost invariably present in cases of infantile Syphilis. Amongst adults they are commoner with syphilitic women than with syphilitic men.

They occur in situations where the skin at the various orifices of the body joins mucous membrane; in the various mucous passages near to their external orifices; on the skin in the neighborhood of the orifices of mucous passages; and in places where the skin is fine and habitually moist, as in folds where the opposite surfaces of the skin are frequently in contact.

Thus they are common on the vulva, at the margin of the anus, on the lips, on the margins of the nostrils, in the lower part of the rectum and vagina, on the tongue, on the lining membrane of the cheeks, on the tonsils, on the uvula, on the posterior wall of the pharynx, on the cheeks, in the clefts of the alæ of the nose, on the prepuce, in the cleft of the nates, on the scrotum, on the upper part of the inner surfaces of the thighs, in the groin, in the umbilicus, in the axillæ, between the toes and around the nails.

Mucous patches are rarely attacked by ulceration. When they are disappearing they gradually dwindle (are atrophied), their secretion is diminished, and they become the seat of a moist flaky desquamation, till at last nothing remains of them but a livid stain, which gradually fades, leaving no scar behind it.

The *prominent* kind of vegetative Syphilide is known under the names of "condyloma," "syphilitic wart," "cauliflower excrescence," &c.

This, like the mucous tubercle, presents a somewhat different aspect, accordingly as it is developed in an exposed situation or occupies some cleft, where it is protected and kept moist by the contiguous surfaces of the cleft.

In the one case it will be an ash-gray dry wart, hard and rasp-like to the touch; in the other it will be composed of semi-transparent, pink-colored, moist, ill-smelling, fungous granulations. It may be sessile or pedunculated. Its constituent papillæ may be confluent, or, as is often the case, distinct, so that the growth is digitate.

It occupies the same situations as the mucous tubercle.

Diagnosis. — The mucous patch can scarcely be confounded with any other lesion of the skin. The diagnosis of the syphilitic cauliflower excrescence, however, is not always so clear, since growths which are undistinguishable in appearance from syphilitic warts are to be met with about the anus and genitals in cases where there is no reason to presume that they are due to syphilitic infection. In instances where the nature of the warty growths is a matter of doubt, the history of the case and the presence or absence of other syphilitic symptoms will furnish aids to the formation of a diagnosis.

Exanthematous Syphilide ("Syphilitic Roseola") is one of the most frequent and early of the symptoms of constitutional Syphilis. It appears in rounded patches of the size of a sixpenny-piece or a shilling, having irregular broken margins. Their color, at first of a bright rosy hue, acquires afterwards a tawny coppery tint, and finally disappears as a cold-gray stain. Both at its commencement and at its termination, however, the eruption is very faint, and may easily be overlooked. The patches, which are tolerably numerous, may be either distinct from or may run into one another; in the latter case a sort of irregular web is formed, which, inclosing islets of unchanged skin, gives a mottled appearance to the surface. When recent the eruption can be made to disappear momentarily under the pressure of the finger, but later on it loses this quality. Its appearance is preceded usually by slight febrile disturbance lasting a day or two.

The roseolous rash generally lasts for one or two months, affecting some portion of the trunk or upper part of the arms or thighs. It makes its appearance about a month or two after primary infection. It is scarcely ever accompanied either by itching or smarting; as it fades a transient desquamation will sometimes take place, but no ulceration or cicatrization. It leaves behind it, however, dull-gray stains, which often persist for a long while. It coincides occasionally with other of the earlier manifestations of secondary syphilis — redness or opaline infiltration of the mucous membrane of the mouth or fauces, mucous tubercles, rheumatic pains in the limbs, papular and other early Syphilides.

The Prognosis as regards the eruption itself is favorable since it is a mere rash, which disappears after a comparatively short duration, leads to no destruction of tissue, and leaves behind it no permanent trace; but, viewed as a symptom of constitutional syphilitic infection, its appearance indicates that the subject of it is more or less liable to further manifestations of constitutional Syphilis.

Diagnosis.—This will be facilitated by the coexistence of a chancre, or at least of the recent cicatrix of one on the genitals. The affection may, however, be mistaken for Measles, Scarlatina, or Roseola.

But in *Measles* the eruption commences on the face, has a crescentic arrangement, and is of a mulberry color, the eyelids are much swollen, and there is coincident coryza and bronchitis. In *Scarlatina* the eruption is most intense on the upper part of the chest, is punctiform, and is of a bright scarlet color, the redness of the throat, too, is of a brighter hue than the dusky redness of syphilitic angina. *Roseola* is attended with itching, its duration is much briefer, and it fades without undergoing the changes of color peculiar to the exanthematous Syphilide.

Vesicular Syphilides are among the earlier manifestations of constitutional Syphilis; they are not, however, of frequent occurrence. They have been named respectively after the "*non*-specific" eruptions that most resemble them — "*Syphilitic* Eczema," "Herpes circinatus," "Varicella," and "Herpes phlyctænodes."

"*Syphilitic Eczema*" is characterized by the development of numerous small vesicles clustered together on a reddened surface, which soon acquires a tawny hue. The eruption occurs in irregularly-shaped patches of limited size; the vesicles last for several days, after which they either shrivel and are replaced by furfuraceous scales, or become ruptured and are succeeded by minute crusts, which on falling disclose small brown stains, which in their turn slowly disappear. The eruption may be prolonged over a variable period by a succession of several crops of vesicles.

Syphilitic Herpes circinatus appears in the form of small elevated reddened patches surmounted by clusters of minute vesicles; the circumference of each of these patches rapidly extends at the same time that the centre subsides and fades, so that the eruption speedily assumes the form of narrow reddened elevated rings, each inclosing an area of skin which is either of the natural color or but slightly tinged with red: the rings are surmounted by minute vesicles, or more commonly by minute furfuraceous scales, and soon acquire a tawny hue. The patches may be either few in number and confined to a limited region or extremely numerous and widely spread; in the former case they occur usually on the sides and back of the neck, in the latter they are thickly scattered over the greater part of the body and give it a peculiar and variegated appearance.

Syphilitic Varicella.—In this variety the vesicles are large, distinct from one another, and scattered irregularly over the

surface; they are surrounded by slightly elevated red areolæ, which steadily acquire a coppery tinge. After lasting for a week or ten days the vesicles burst and are replaced by dark-colored, greenish-brown, adherent crusts, which at length separate, leaving in their place brown stains, which persist for some time. When the eruption is more or less clustered so that the areolæ of several neighboring vesicles become fused, it has been termed "*Syphilitic Herpes phlyctænodes.*"

Vesicular Syphilides appear within a few months after contagion and last a month or two; they coincide usually with such other syphilitic symptoms as have been mentioned in the description of the exanthematous Syphilide.

Prognosis.—What has been said respecting "syphilitic Roseola" on this head applies equally to the vesicular Syphilides.

Diagnosis.—The comparatively long duration of the vesicles individually, taken with the general diagnostic signs of cutaneous Syphilis, will suffice usually for the recognition of syphilitic vesicular eruptions.

Squamous Syphilide, one of the earlier and commoner of the syphilitic eruptions, is of three kinds—"syphilitic psoriasis guttata," "syphilitic psoriasis circinata," and horny Syphilide.

"*Syphilitic Psoriasis guttata*" is characterized by the appearance of reddened disk-shaped elevations of the skin, which are scantily covered by small, dry, dingy-white, thin scales. The inflamed disk soon assumes a coppery tinge, and its circumference, which is bare of scales, forms a tawny-red areola around its scale-covered portion. The patches, which are as a rule rather oval than rounded, vary in size from that of a split-pea to that of a shilling, rarely exceeding the dimension of the latter; they are distinct from one another though sometimes closely set. This variety is usually spread pretty extensively over the whole surface of the body, but is perhaps more developed on the inner surfaces of the limbs than elsewhere.

"*Syphilitic Psoarisis circinata*" begins as slight, scurf-covered, reddened elevations, which as they extend subside at their centre so as to acquire the form of rings. These papular rings, which may be complete or incomplete, are of a tawny-red color, and are surmounted by small, thin, dingy-white scales; their average diameter is that of an ordinary finger-ring. The disease may remain almost stationary in this condition for some time, till at length the scales disappear and the elevation subsides and is replaced by a deeper-colored tawny-brown stain. This variety occurs on the face, neck, and limbs.

Horny Syphilide.—This affects exclusively the palms of the hands and the soles of the feet. It appears first as rounded, slightly elevated, tawny-red patches of the size of a split-pea; these gradually increase in size till they acquire the diameter of a fourpenny- or a six-penny-piece. Gradually the epidermis covering them becomes thickened, dry, hard, opaque, and yellow—assumes in short a horny appearance, and at length begins to separate in flakes. The disk of altered epidermis is surrounded by a tawny-red areola. Sometimes a large patch of this kind will completely cover the posterior part of the sole of either foot, the epidermis acquiring in this situation an extraordinary thickness and separating in large thick plates. After a time the desquamating patches are replaced by yellowish-brown stains, which gradually disappear.

The Prognosis of the squamous is the same as that of the exanthematous Syphilides.

Diagnosis.—"Syphilitic" Psoriasis may be mistaken for "simple" Psoriasis. But in simple Psoriasis the knees and elbows are almost invariably attacked, the face rarely so; the outer surfaces of the limbs and the lower part of the back are the regions chiefly affected; the scales are abundant and imbricated and have a nacreous lustre; the surface on which they rest is harsh and wrinkled; it is redder and less tawny than in the squamous Syphilide. A narrow dingy-white circle commonly surrounds the areola bordering the syphilitic scaly patch. This appearance is caused by a ring of altered and partially-detached epidermis, it is less frequently present in simple psoriasis, and in the latter disease is thicker and presents a nacreous lustre, but it is not (as has been supposed) a pathognomonic sign of constitutional Syphilis, nor is it limited to squamous eruptions.

The horny Syphilide can scarcely be mistaken for any other eruption.

The symptoms which have been already mentioned as distinctive of the Syphilida generally will facilitate the diagnosis of squamous Syphilides from non-syphilitic eruptions.

Papular Syphilide is the most common of all the syphilitic eruptions. It appears usually within two or three months after the occurrence of primary Syphilis, and is accompanied by other of the earlier symptoms of constitutional Syphilis. It is occasionally preceded by slight febrile disturbance, which subsides as the eruption comes out. It may coincide with apparently the most perfect general health.

Syphilitic papules are small, solid, firm, shining elevations, which contain neither serum nor pus. Their color is at

first, and for some time, a bright red or rose color, which can be made to disappear momentarily by the pressure of the finger. Afterwards, as they are beginning to fade, they gradually assume a tawny tint, which, as they slowly disappear, becomes more and more pronounced. After this change of hue the color of the papules will no longer pass away under pressure.

Soon after a papule has attained its full size its top becomes covered with a small white scale.

There are two varieties of papular Syphilide, the conical and the flat.

In the *conical* variety (the so-called "*syphilitic Lichen*") the papules are small and cone-shaped. They are distinct from one another, not confluent as in simple Lichen, and are thickly scattered over a large extent of surface.

In the *flat* variety the papules are much larger and flatter, and are less numerous. Their average size is that of a threepenny-piece. In these papules the tawny hue becomes deeper than in the conical kind.

Not unfrequently both varieties are found together.

Papular Syphilide affects especially the upper half of the body, viz., the face, the neck, the upper limbs, the back, and the chest. The average duration of each papule is from three to six weeks, but as the eruption usually comes out in a succession of crops the disease may in this manner be prolonged over several months. The papules terminate in resolution, leaving behind them either dull yellow-brown stains, or in some cases small depressed cicatrices, which for a long time retain the tawny hue, but at length disappear completely.

The prognosis of the papular is the same as that of the exanthematous Syphilide.

Diagnosis.—The eruptions for which papular Syphilide is apt to be mistaken are Lichen, Prurigo, Erythema (papulatum), Acne (indurata), and tubercular Syphilide.

However, in *Lichen* the papules are not shining; they are closely agglomerated, and are much smaller than the syphilitic papules. In *Prurigo* the papules are paler and of smaller volume than in the papular Syphilide, and they are surmounted generally by a small black crust. In *Erythema papulatum*, on the other hand, the papules are more voluminous than in the disease under consideration, and change soon from a rose-red to a purple hue. Their duration is much briefer than that of the syphilitic papules. In *Acne indurata* the coexistence of other varieties of Acne, the fact that from some of the (suppurating) papules a curdy sebaceous matter may be expressed, the absence of the eruption from the chest, abdomen, and arms, and its somewhat purple hue, will suffice for distinction. But the diagnosis of papular Syphilide from either of the above-named diseases will be greatly facilitated by a recollection of the characters which have been already enumerated as distinctive of the Syphilida generally. From *tubercular Syphilide* the papular disease is distinguished by the smaller size of its pimples, by their not leading to ulceration, and by their not producing a permanent cicatrix. Again, syphilitic tubercles appear usually at a much later period after contagion than do the papules, and coincide with other of the later phenomena of constitutional Syphilis.

Pustular Syphilides.—At one time syphilitic eruptions were all of them believed to be of a pustular character; the term "pustular," however, can with propriety be applied only to three kinds of syphilitic eruption. These have received the names of Syphilitic Acne, Syphilitic Impetigo, and Syphilitic Ecthyma.

Syphilitic Acne, one of the earlier Syphilides, appears in the form of numerous isolated papules, each of which is surmounted by a small pustule. The average size of the pimples is that of a hemp-seed. The solid base, at first of a rosy-red color, gradually acquires a brownish tint, and the small mattery head slowly dries up, producing a yellowish-brown crust, which at length falls off. The papule capped by it becomes absorbed, and is replaced by a small rounded depression of a tawny brown-red color, which after a scanty desquamation either disappears completely or is replaced by a small rounded depressed cicatrix.

The pimples, which occupy usually a considerable extent of surface, may either be scattered equably over the region affected or be collected into groups, but are generally, in either case, perfectly distinct from one another.

The favorite situation of the eruption is the back, but it appears also on the face, upper limbs, and thighs.

Each pimple runs a chronic course, lasting for about a fortnight. The average duration of the disease altogether is about three or four months. The invasion of the disease is sometimes gradual, but in other cases an extensive surface becomes thickly covered in a comparatively short space of time. There is then slight febrile disturbance, lasting for two or three days.

This variety is often associated with conical papular Syphilide, in some places the papules predominating almost to the exclusion of pustules, in some being mixed in equal proportion with them, while in others the eruption will be exclusively pustular.

Prognosis.—The eruption rarely exceeds a duration of four months, exercises no apparent influence on the general health, except the febrile disturbance it sometimes

occasions at its outset, and leaves but slight traces behind it.

Diagnosis.—It may be mistaken for Acne, but the Syphilide is generally more extensively spread. The grouped arrangement is one that rarely occurs in Acne. Acne is a more chronic disease, and it exhibits generally a purple tint. The scars left by Acne are linear and elevated, those left by the acniform Syphilide are rounded and depressed. In Acne there is more or less curdy matter contained in some of the pimples.

Syphilitic Impetigo is of two kinds, the superficial and the deep.

The *superficial variety* is one of the earlier syphilitic eruptions, and is associated often with syphilitic Roseola or with syphilitic Lichen. It appears in the form of small pustules. These are generally arranged in small clusters on rosy-red patches of skin, which soon acquire a tawny hue. The pustules are soon replaced by uneven, brown, somewhat thin crusts, which falling, leave superficial cicatrices, which retain for some time a tawny-brown color. The eruption is sometimes preceded for a day or two by slight febrile disturbance. It may be kept up for some time by a succession of crops of pustules. It is common on the hairy scalp, but it occurs also on other parts of the body.

The *deep variety* is a tertiary Syphilide, and occurs usually in cachectic persons, more particularly in those in whom the "syphilitic cachexia" has become developed. It is a more chronic disease than the superficial variety. It begins by an elevated reddened patch, on which numerous confluent pustules appear. These become speedily replaced by a dark-green, uneven, tolerably thick crust, which conceals a moderately deep ulcer, having a coppery margin, clean-cut edges, and a grayish floor. After lasting for some time the crust falls, leaving depressed, well-marked, livid cicatrices, which gradually acquire a brown hue and at length become blanched. This variety is common on the face.

Prognosis—of the superficial variety as of syphilitic Acne; of the deep variety as of syphilitic Ecthyma.

Diagnosis.—Syphilitic Impetigo may be mistaken for simple Impetigo, but the latter occupies generally a more extensive surface, is characterized by a more abundant purulent secretion, which produces crusts of a lighter color. The pustules have a briefer individual duration, the inflamed skin does not acquire a coppery hue, no ulcers are produced, nor does the eruption after it has disappeared leave behind it any cicatrices.

Syphilitic Ecthyma is characterized by the development of large isolated pustules, which become replaced by thick dark-colored crusts covering ulcers.

There are two varieties of it, the superficial and the deep.

The *superficial* appears earlier and is less severe than the deeper variety. It commences in the shape of small, scattered, reddened patches, on each of which a pustule is shortly formed. The pustules when fully developed vary in size from that of a split-pea to that of a split-bean; they are prominent and rounded; their base is not solid and indurated as in the acniform syphilide, but they are formed entirely of a collection of pus; they are surrounded by a tawny-red areola, and after a short time they burst and the tenacious liquid they contain concretes into a moderately thick, rugged, greenish-brown, not very adherent crust, covering a shallow but characteristic ulcer: this at length heals under the crust, leaving a dusky superficial but often permanent scar, which becomes gradually blanched. This variety occurs on the scalp, where it gives rise to permanent circumscribed baldness; on the limbs, more especially the lower limbs; and on the nates. It is a not uncommon form of infantile Syphilis appearing a month or two after birth. But in infants I have noticed that it presents special characters which it may be well to mention. Thus it appears at first in the form of conical tubercles, which gradually suppurate throughout their whole extent, commencing at the summit, and it is peculiar too in affecting the palms of the hands and the soles of the feet.

The *deep* variety (which ranks among the tertiary Syphilides) commences as an elevated livid spot, which is soon replaced by a pustule containing sanious pus, and resting on a livid, slightly elevated, indurated base, which is broader than the pustule; the pustule gives place to a thick nodulated crust elevated at the centre, of a dark-greenish color, let into the thickness of the skin and surrounded by a tawny-brown swollen areola. The crust conceals a deep ulcer with perpendicular edges, and a gray slough-like floor. After a time this heals, and the crust falls, disclosing a well-marked, depressed, livid cicatrix, which gradually becomes bleached.

Syphilitic Ecthyma occurs more especially in the cachectic, whether the cachexia be more immediately due to the syphilitic virus or to some other cause. Thus it occurs in those who, contracting constitutional Syphilis, have had their vigor impaired by intemperance, debauchery, privation, or exposure; it occurs too in infants, and in persons in whom the syphilitic cachexia has begun to manifest itself.

The superficial variety appears from six months to a year or more after primary Syphilis, the deep variety usually

much later. The disease is generally, by a succession of pustular crops, prolonged over a considerable period.

Prognosis.—This as regards the probable duration of the eruption, and the extent of disfigurement likely to be occasioned by it, may be stated as being intermediate between that of syphilitic Acne and that of syphilitic Rupia. The prognosis of the deep will be graver than that of the superficial variety.

Diagnosis.—Syphilitic Ecthyma is very apt to be confounded with simple Ecthyma (cachecticum), and the diagnosis is sometimes difficult, unless the history of the case, and the presence or absence of other indications of constitutional Syphilis be taken into the account. However, in the simple eruption the areolæ surrounding the scabs are purplish rather than coppery, the pustules in the majority of cases are confined to the lower limbs, and the individuals attacked are generally either infants or aged persons. In the latter the disease is often complicated with the characteristic indications of Prurigo senilis, which disease the Ecthyma is in such cases secondary to; syphilitic Ecthyma, on the other hand, occurs on all parts of the surface, including even the head and face, and is commoner in adult age.

The Bullous Syphilide (*Syphilitic Rupia*) is one of the latest and most inveterate of the Syphilides. It appears in the form of tolerably large blebs; these are of an irregularly rounded outline, have a flat and somewhat wrinkled surface, project but slightly above the level of the skin, and contain a turbid sanguineous serum, which is of a brownish color. They are surrounded by a red areola, which speedily assumes a tawny-brown tint. After lasting for a short time the bleb becomes ruptured, and the liquid it contains dries up into a thick, hard, very adherent, dark-brown, or more often dark-green crust, beneath which is an ulcer. The firm adhesion of the scab, the extremely chronic character of the sore which produces it, and the tendency of the latter gradually to spread, produce a peculiarity in the shape of the incrustations which is very characteristic of the disease; thus they are generally moulded in the shape of an oyster-shell or of a limpet-shell. This arises from their being produced in successive layers, which, as the ulcer spreads, become progressively larger and larger. When the exudation is scanty, and the spread of the ulcer comparatively rapid, the oyster-shell shape results; when the purulent secretion is profuse, and the ulcer extends rather in depth than in area, the limpet-shell shape is produced. In the flatter variety the resemblance to an oyster-shell is increased by the surface having a more or less flaky appearance, and in the more prominent kind the limpet-shell appearance is often enhanced by the crust being studded with a number of small obtuse nodules. Sometimes the thickest of these crusts are somewhat constricted at the base; this may be noticed occasionally when they affect the neighborhood of the face. The ulcers are large (attaining sometimes the size of a crown piece), are irregularly rounded, and have perpendicular edges; their floor is formed either of flabby granulations or of a tenacious slough-like layer, and they discharge a fetid, sanious, plastic pus: they are deeper under the thicker crusts. The number of the rupial patches varies greatly; thus even in a long-standing case there may have been but two or three, while in other instances their number is very considerable.

In some cases the disease assumes a serpiginous character, spreading centrifugally over a large extent of surface. Its mode of progression and the general appearance which it presents under this condition will be found described under the head of "ulcerating tubercular Syphilides," with this difference only, that in this, the rupial affection, the outer rim is formed by purulent blebs instead of tubercles. The cicatrices left by the ulcers present the various appearances described in the account of the ulcerating tubercular Syphilides.

The rupial Syphilide may occupy any region, and is sometimes spread over the greater part of the surface, but it affects preferably the lower limbs or the head (scalp or face). It is met with usually in debilitated or cachectic subjects, especially in those in whom the general condition known as the syphilitic cachexia has become confirmed.

It rarely appears earlier than a year or two after primary Syphilis, and may not be developed till several years have intervened. It is usually of long duration, and if not cut short by suitable treatment may even last many years.

Prognosis.—This will be unfavorable either as regards immunity from permanent local effects or the prospects of speedy recovery. The eruption invariably leaves behind it conspicuous scars, which will be disfiguring in proportion to the depth or the area of the ulcers they succeed, and the period of recovery will be remote according to the degree in which the general health is affected.

Diagnosis.—Syphilitic Rupia, or as it should more properly be termed, rupial Syphilide, is so peculiar in its appearance as to be scarcely liable to be mistaken for any other cutaneous disease. The only disease that at all resembles it is Lupus, but the pale granulations that form the floor of the ulcers of Lupus and the other diagnostic characters mentioned else-

where as distinguishing Lupus from the tubercular Syphilides, are sufficient to prevent an error of this kind.

Tubercular Syphilide, or "syphilitic Lupus," as it is sometimes termed, is a not uncommon form of syphilitic cutaneous disease. It is one of the later phenomena of constitutional Syphilis, and does not usually appear until after the occurrence of some of the earlier manifestations of the syphilitic diathesis. It may present itself for the first time many years after contagion, but at any period is always a very persistent affection. It is one of the "tertiary" or more inveterate forms of cutaneous Syphilis.

Tubercular Syphilide is of two kinds, the one, usually of earlier development than the other, very rarely leads to ulceration, while in the later and graver kind ulceration is invariably produced.

The former kind comprises two varieties, *the clustered* and *the scattered*.

The latter kind is divided, according to the character of the ulcers induced by it, into *the perforating* and *the serpiginous* varieties.

The clustered non-ulcerating variety is the commonest form of tubercular Syphilide. It appears in the form of small, rounded, prominent, reddened tumors. These gradually acquire a dusky coppery-red color, and their surface becomes tense and shining; their size varies from that of a pea to that of a nut. They are generally disposed in small circular or elliptical rings, which, though sometimes complete, are more frequently interrupted in two or three places, or even each of the component tubercles may be perfectly distinct from the rest. The area inclosed by the circle, as well as the intervals where the continuity of the latter is broken, is sometimes occupied by a superficial, tawny-brown, slightly desquamating cicatrix. In other instances the tubercles are disposed in small irregular groups; when thus arranged they are smaller, harder, and more prominent than when in the annular form. They terminate ordinarily, although not invariably, in resolution, their surface losing its polished appearance and becoming slightly scaly, their substance getting soft and flabby, and their prominence gradually diminishing till at last a depressed indelible cicatrix is left, which retains for some time a tawny-brown color. This cicatrization is the result of the interstitial absorption of the disorganized tissue, and takes place without breach of surface. Sometimes, however, the tubercles ulcerate and become covered with dark-green crusts, under which are formed cicatrices of the kind just described. The variety of tubercular Syphilide appears most commonly on the face (forehead, nose, mouth, or chin); on the forehead it has received the name *corona veneris*. It runs a chronic course, lasting usually for several months.

The scattered non-ulcerating variety occurs in the form of small, rounded, or oval tumors, varying in size from that of a pea to that of a hazel-nut. They are sprinkled thickly or thinly, but in either case pretty equably, over the region occupied by them. Their color, at first a deep red, soon changes to a tawny coppery-red. They are of a pretty firm consistence. Their surface is shining, and they have a peculiar infiltrated semi-transparent appearance. After a time their somewhat flattened summit becomes covered with a thin, whitish, adherent scale, which gradually peels off at its circumference, and at length becomes completely detached. After this the tubercle begins to get flabby and to diminish in size, and finally disappears leaving a depressed, brownish, indelible scar, the color of which slowly fades away. In some instances the cicatrix altogether becomes after a time so faintly marked that it may be a matter of some nicety to establish its existence. This variety is met with principally on the face, but it occurs on the trunk and arms. Its duration extends usually over several months.

The perforating ulcerating variety appears in various situations, but usually on some part of the face, in the form of two or three clustered tubercles. These are of comparatively large area, varying in size when fully developed from that of a threepenny-piece to that of a shilling, or even of a half-crown. Their elevation above the level of the skin is but slight in proportion to their size. They are however deeply rooted. They are rather subcutaneous swellings than actual tubercles. At first they are hard, firm, and elastic, and the skin covering them is reddened, the redness gradually acquiring a coppery character. After a time the tumor softens, the coppery-red skin becomes livid and thinned, and at length ulcerates. A black, dry, thick, rugged crust soon forms over the sore. On detaching the scab a deep ulcer having perpendicular edges (as if it had been cut out with a punch) and a gray slough-like floor is laid bare; from this a fetid, sanious, plastic discharge exudes, which, concreting speedily, reproduces the crust. Under this the ulcer, without extending notably in area, gradually increases in depth, eating its way slowly through whatever tissues may lie next beneath it, even cartilage or bone. The margin of the ulcer is surrounded by a coppery-red areola. The duration of the affection is always long. Its progress may become arrested either spontaneously or under the influence of treatment; the ulcer then becomes cleaner, florid granulations take the place of the gray slough-like substance that formed its floor, it

becomes shallow, and at length cicatrizes. The scars left by this variety of Syphilide are usually somewhat depressed below the level of the skin; they may either be polished and even, or puckered and intersected by raised tendinous bands, which meeting one another give rise to hard tendinous knots. When recent the scars are of a livid coppery color, this changes slowly to a dull-brown; which becoming gradually fainter and fainter at length disappears, and a dull-white indelible scar is left.

The serpiginous ulcerating variety begins by red, hard, shining tubercles, which gradually assume a coppery tint; after a time they soften, their summits ulcerate and become covered with hard, dark-colored, uneven crusts, and on detaching one of the crusts a shallow but abrupt ulcer is disclosed, having a gray pultaceous floor and exuding a sanious pus, which soon reproduces the crust: under this by degrees the ulcer granulates up and gets glazed over with a livid-brown, tolerably smooth cicatrix, which in process of time becomes blanched.

While the tubercles that first appeared are undergoing these changes, fresh ones are developed close around them, and while they in turn are following a similar course a third crop is appearing immediately beyond. In this way the disease extends centrifugally, its margin being formed by tubercles with, immediately behind them, a broken row of crusts, while the cicatrix in the interior is gradually being increased in area by successive additions to its circumference. Usually, however, the widening circle of active disease becomes broken and incomplete, owing to portions of it healing, and the rest of it continuing to spread, the patch of altered skin, instead of remaining discoid, acquires an irregular shape. The broad cicatrices left by this affection are in some cases smooth and even, though usually somewhat pitted, in others, however, they are puckered, and resemble the scars of severe burns. This variety of tubercular Syphilide occurs on the back, the chest, the face, and on the limbs in the neighborhood of the joints. There are often several patches of it at a time.

Prognosis.—The different varieties of tubercular Syphilide are not all of them equally chronic, nor does each affect the general health in the same degree, nor are they similar in the matter of leaving behind them permanent scars.

In either of these respects the prognosis of the ulcerating will be less favorable than that of the non-ulcerating varieties.

As regards chronicity, the duration of either of the non-ulcerating varieties extends usually over a range of several months, while the ulcerating kind may be prolonged over several years.

The scattered non-ulcerating variety produces the least permanent defacement, while the perforating ulcerating variety is the worst in this respect; indeed the large destructions of tissue produced by the latter, and its preference for the face, cause sometimes the most hideous disfigurement: thus one of the alæ, or even the greater part of the nose, may be destroyed, the mouth may be greatly deformed, an eyelid may be wanting, the frontal bone may be perforated, or even, as I have had occasion to see, a large part of the calf of the leg may get eaten away. The same variety too is the most chronic of the tubercular Syphilides, and is the least amenable to treatment. It is moreover attended with a more marked deterioration of the general health than any of the others.

The serpiginous is neither so persistent, so obstinate, nor so grave an affection as the perforating variety; still it leaves most extensive (although superficial) permanent scars, and when copiously developed it is apt to impair considerably the general health.

Diagnosis.—The *scattered non-ulcerating* variety may possibly be confounded with Acne indurata, but in the latter there is usually an oily condition of the neighboring skin. The syphilitic tubercles are more superficial than those of Acne, which are more or less deeply imbedded in the substance of the skin; the latter commonly suppurate, and on puncture may always be ascertained to inclose a small collection of sebaceous matter in their centre. The scars left by them are elevated and linear, those left by the syphilitic tubercles are on the contrary rounded and depressed. The extent of surface occupied by the eruption of Acne is usually more limited, and the nodules are of a somewhat purplish, or at the least of a crimson red, whereas the area of the syphilitic eruption is comparatively extensive, and its nodules soon acquire a coppery hue.

The *clustered non-ulcerating* variety, to which the name of "syphilitic Lupus" more especially belongs, is very apt to be mistaken for (scrofulous) Lupus properly so called, and this more particularly when it affects the nose or the cheek, which are the common situations of Lupus. But the tubercles of Lupus are commonly of a purplish hue; they are more flabby and have a duller surface—that is to say, they want the tense shining appearance of the syphilitic tubercles; they are often accompanied by a puffy state of the neighboring subcutaneous cellular tissue. The ulcers produced by the scrofulous disease either have undermined edges or are ill-defined at their margin, and their base is composed of pale flabby granulations, whereas those of the syphilitic eruption have clean-cut abrupt margins and a slough-like floor.

The scars of Lupus are irregular, contracted, and often ridgy, while the syphilitic scars are circular, even, and depressed.

Lupus appears generally during the juvenile age, the tubercular Syphilide during adult age, and although the latter may fairly be considered a chronic eruption, its chronicity is as nothing in comparison with that of Lupus, which progresses by almost imperceptible gradations, and endures for many years.

When arranged in rings the clustered variety may be possibly confounded with Psoriasis circinata, but in the latter the reddened ring is more continuous, its surface is rougher and duller, and it is covered with scales, which exhibit a nacreous sheen.

The *perforating variety* of the tubercular Syphilide can scarcely be mistaken for any other cutaneous disease.

The *serpiginous kind* is liable to be mistaken for a phagedænic chancre, but with the latter no symptoms of *constitutional* Syphilis are present, the ulceration extends more rapidly, and spreads from the ordinary situation of the chancre (the neighborhood of the genitals) ; moreover, the sore is inoculable.

Treatment of the Syphilides.—The remedy *par excellence* for constitutional Syphilis is mercury ; attempts have been made from time to time to discover some better remedy, and now and then it has been the fashion to enlarge on the dangers and disadvantages of employing this drug in the treatment of Syphilis. It has been said that the worst results of so-called tertiary Syphilis were due rather to the remedy than to the disease, and it has even been proposed that Syphilis should be left altogether alone as being a very innocent affection in itself, provided it were not meddled with. Nay, some have gone further even than this, and have steadfastly advocated that the syphilitic patient should be, if possible, still further infected by the repeated inoculation of chancrepus at various parts of his body, and that this process should be persevered with until he became so thoroughly syphilitic as to be quite well! This doctrine (of "syphilization") has had some illustrious advocates. But notwithstanding all that has been urged against the use of mercury in Syphilis, it still holds its gronnd as the most valuable of anti-syphilitics. It may be confidently stated that no means of treating Syphilis that has yet been proposed can compare with mercury in efficacy and in rapidity of action, and that no remedy is attended with less disadvantages provided it be used with discretion. At the same time it must be admitted that, although the best, it is by no means a perfect remedy for Syphilis.

It is useless prescribing a course of mercury for a person affected with an indurated chancre in the expectation of securing him by such means immunity from all further manifestations of constitutional Syphilis, and it is equally futile to persist in administering small doses of the drug after the total disappearance of all perceptible symptoms of constitutional Syphilis in hope of "thoroughly eradicating the syphilitic virus" by this process. Either of these precautions is about as idle as the no less popular plan of continuing to administer arsenic in cases of (simple) Psoriasis long after the eruption has disappeared with the view of preventing any future attack by removing in this way any "lurking traces" of the disease that may remain in the system. For clinical experience shows very clearly, both in the case of the acquired (syphilitic) diathesis as well as in that of the congenital diathesis on which Psoriasis may be assumed to depend, that this anticipatory medication is valueless as a means of warding off future manifestations of the constitutional taint.

In the administration of mercury as an anti-syphilitic it is important to bear in mind that it is far better to give too little than too much.

In the earlier and more tractable manifestations of constitutional Syphilis, such as the papular and squamous Syphilides, it will usually be found, if the drug be administered in moderate doses, that the eruption will begin to fade very perceptibly before the gums begin to be affected, and in such cases it will rarely be necessary to push the remedy to the extent of affecting the gums at all. So long as the eruption continues to fade the drug should be withheld until the stationary condition of the eruption again demands its use. Indeed, in all cases it is preferable to fall back on the eruption as our guide in regulating the use of mercury, rather than to push the use of the remedy to the unnecessary extent of affecting the gums, in order that they may serve as an indication of its effect.

Accordingly, in the tertiary manifestations of Syphilis, which under any circumstances cannot be made to disappear so speedily as its secondary and more tractable symptoms, mercury should be given in still smaller doses, and greater patience should be exercised in waiting for the first appearance of a change for the better in the character of the eruption. When improvement, however, has once commenced, the condition of the eruption is the indication to be obeyed, provided that it be kept in mind that a far more gradual progress than in the case of the earlier Syphilides is the best result that can be obtained.

As to the form in which mercury should be given—that is to say, what compound of it should be employed, and as to the way

in which it should be introduced into the system, whether by the skin (inunction, fumigation), by the nostrils (insufflation), or by the mouth (inhalation, pills, mixtures)—opinion is somewhat divided; but there appears to be no sufficient reason why the usual and most convenient way of taking remedies, viz., by swallowing them, should be deviated from when mercury is employed as a remedy for constitutional Syphilis, and the balance of opinion is in favor of this method of introducing the drug.

It is equally in favor of choosing the green iodide as on the whole the most suitable compound of mercury for use in this way. The dose of the green iodide, in the case of the earlier Syphilides, should be from a quarter of a grain to half a grain given thrice or twice a day in the form of a pill. In the later Syphilides half this dose is sufficient. Should any irritation of the stomach or bowels be occasioned by the pills, the addition of a small quantity of opium (a quarter of a grain to each pill) should be made.

From the foregoing it will be evident that the author considers mercury to be a remedy of great value in the treatment of tertiary as well as of secondary Syphilis. Many, however, while fully admitting the value of mercury in secondary Syphilis, consider that the remedy *par excellence* for the tertiary or later manifestations of the disease is the iodide of potassium, and that mercury in such cases is always useless and sometimes harmful. The iodide of potassium is doubtless a remedy of great value in tertiary Syphilis, but it is as an adjunct to and not as a substitute for mercury that it should be used. It is especially of value in relieving the *pain* of constitutional Syphilis, secondary as well as tertiary. It allays the wandering rheumatic pains that often accompany the earlier Syphilides, and is of equal efficacy in the fixed aching (osteocopic) pains in the bones, and in the darting (neuralgic) pains in the temples, that accompany the later phenomena of Syphilis. It is also of value in promoting the resolution of (secondary) syphilitic nodes, as well as in favoring the absorption of the plastic deposits (cutaneous and other) that are so frequently met with as tertiary symptoms. It may be given in doses of three to ten grains thrice daily. The iodide of iron is with many a favorite remedy in tertiary Syphilis, and it is a valuable adjuvant to mercurial treatment in cases where there is much pallor and well-marked cachexia.

Cod-liver oil is useful in similar cases.

Sudorifics are believed by many to assist the action of mercury in Syphilis; accordingly the compound decoction of sarsaparilla taken warm is a favorite addition to the usual treatment. The same idea is embodied in the plan of treating Syphilis by mercurial fumigations, or by warm-baths containing a small quantity of corrosive sublimate in solution. The administration of simple vapor-baths is by some preferred to the internal administration of sudorifics.

Whatever may be the theory on which sudorifics are adopted (whether it be that by such means the "syphilitic virus" is sweated out of the system, or that by repeatedly determining a flow of blood to the skin the action of the mercury is specially directed to the situation of the eruption), the use of them does not appear either to hasten the disappearance of the eruption or to insure the patient against a relapse of it.

It is almost unnecessary to insist on the advisability of the patient's taking care of himself while he is under a course of mercury, or to say that he should avoid strong exercise, late hours, and exposure to wet and cold, and should adopt a moderate and unstimulating diet.

When the health has been much shattered, a short preparatory course of treatment may be advisable before specific treatment is entered on, such as the repeated administration of mild aperients, a nourishing and stimulating diet, a course of tepid salt baths, quinine, &c.

In cases where mercury has been taken on several previous occasions benefit may often be obtained by the iodide of potassium given alone. The reason of this is that after repeated courses of mercury a certain portion of the drug often gets deposited in the metallic state in some of the tissues, notably in the liver, spleen, skin, and bones, where it may remain inert for a considerable time. The solvent action of the iodide of potassium again introduces it into the circulation, and its specific effects again become manifested.

Regarding local treatment, many authorities hold that it is useless in the management of the Syphilides, and some advocate that even the deep ulcers of tertiary Syphilis should be allowed to heal by scabbing under the influence of constitutional treatment without means being employed for healing the sores by the direct application of remedies to them. These views, however, are not supported by the facts that have come under the author's observation; he has found that it is possible to heal even extensive eruptions of tertiary Syphilis by the use of local remedies only, and that too without any evidence presenting itself, either during or after treatment, of the system generally being put under the influence of the remedies applied. He is therefore justified in holding that local remedies are a considerable aid to constitutional treatment.

In the earlier Syphilides it will be suf-

ficient to wash the skin well with soap and warm water daily, in order to remove the exudations that may interfere with the direct contact of the remedy with the diseased skin; but in the later Syphilides the incrustations should be softened by the application of poultices, and the ulcer cleansed by washing it with thin gruel and afterwards dried with a piece of soft lint before applying the remedy.

In the earlier Syphilides one of the best applications is an ointment of the nitric oxide of mercury, the oxide being prepared in the wet way, and used in the proportion of gr. xv, or ℈j or even ʒss to the ounce of simple cerate. The later Syphilides require a more stimulating application, and the addition of a small quantity of the red iodide of mercury (gr. j–v to the ounce) should be made to the ointment just described. Iodoform employed as ointment of various strengths, or as powder diluted or not with varying proportions of starch-powder, is a valuable local application in the later Syphilides.

In infantile syphilis the best general treatment is the administration of a grain of gray powder every other day. If there be much emaciation cod-liver oil should be given also.

The local treatment of infantile Syphilis should consist in the application of an ointment of oxide of mercury (the oxide made in the wet way) containing five grains of the oxide to an ounce of simple ointment.

The same ointment should be applied to mucous tubercles, and they should be painted over every second or third day with tincture of iodine, the ointment being of course previously washed off with soap and water.

Cauliflower vegetations are best healed with escharotics in the first place, and the application of oxide of mercury ointment afterwards.

Nitric acid, taken internally, has been praised as an agent in the treatment of the Syphilides, but its advocates consider it useful only in the case of the earlier Syphilides; its fame is due probably to the fact that the earlier Syphilides have a comparatively short duration, and disappear spontaneously after a certain time; at all events this may be said, that its effect, if it have any, is far more gradually produced than that of mercury.

Sarsaparilla has been vaunted as a remedy for constitutional Syphilis, and enjoys a high popular repute in this capacity; but it is quite inert.

SECTION X.

The animal-parasite diseases of the skin are Scabies and Phthiriasis.

Scabies.

Synonyms.—The itch; the Scotch fiddle;[1] The yuck;[2] La gale; La gratelle; Die krätze; Scabrities; Psora.

Definition.—Scabies may be defined as that morbid condition of the skin that results from the presence of the *Acarus scabiei* in the substance of the epidermis. [*Sarcoptes hominis* is the name preferred by some authors.—H.]

Causes.—Scabies is most frequently met with amongst the poor, but the middle and upper classes are not altogether exempt from it. It is commoner with children than adults, and with men than women. Its only exciting cause is the presence of the *Acarus scabiei* in the substance of the epidermis.

The mode by which it is communicated is by the transference of the ova of the acarus from one person to another

Description.—The disease usually makes its appearance in from ten days to a fortnight after it has been communicated. It commences with itching. This is at first limited to the hands and forearms and the lower part of the belly and upper part of the thighs, but it soon becomes general. The itching is at first felt only towards the evening. The eruption of Scabies, which varies in character, will be best described as different diseases of the skin which may be caused by the *acarus*. These are as follows:—

A Pruriginous Eruption.—This is the most frequent of all. It occurs in the form of minute papules, sprinkled loosely over the surface of the skin (not clustered together as in Lichen), exuding from their tops minute drops of serous blood, which concrete into small reddish crusts. The exudation is due, as in Lichen, to the excoriation of the tops of the papules by the scratching of the patient. This condition of the skin is to be looked for chiefly on the palmar aspect of the forearms, on the abdomen and on the anterior and inner surfaces of the thighs.

A Vesicular Eruption.—This appears in the form of small rounded elevations of the cuticle, containing clear lymph, scattered loosely over the surface of the skin, varying in size from that of a pin's head to that of a split-pea, or even larger, and surrounded often with a rosy-red areola of inflamed skin. These vesicles occur on

[1] This time-honored joke against the inhabitants of North Britain is thus alluded to by Coleridge in his celebrated poem, "The Devil's Walk":—

"He took from the poor,
And he gave to the rich,
And he shook hands with a Scotchman,
For he was not afraid of the ———"

[2] "The yuck" is a Scotch synonym for Scabies.

the hands and feet, but more especially on the hands, where they are to be met with chiefly on the backs of the webs of the fingers, on the lateral surfaces of the first phalanges of the fingers, on the back of the thumb and of the web of the thumb and on the front of the wrist. The vesicles are not so constant a symptom of the presence of the itch-insect as the papules. They are absent in about twelve per cent. of the cases of scabies.

A Pustular eruption.—The description that has been given of the vesicles will apply equally to the pustules as regards their shape, their size, their arrangement, and their situation; but besides occupying the situation common to themselves and to the vesicles, the pustules are to be found also on the nates. They differ from the vesicles only in being opaque and yellowish instead of exhibiting a pearly transparency, and in being surrounded with a more decided inflammatory areola.

In addition to the above, eruptions having all the characters of *Eczema* or of *Impetigo* often form a part of the disease. These are to be observed usually about the wrists and ankles, in the flexures of the elbows and knees, and in the female on the breasts. *Furunculi* sometimes occur on the nates, and the author has occasionally met with cases of Scabies where an extensive *urticarious eruption* (although the patients had never experienced an attack of Urticaria before) formed the most prominent feature of the disease.

Besides the above-detailed eruptions, there is another symptom of Scabies which, though less obvious than any of the preceding, is of infinitely greater importance, since it is not only most constantly present, but, once recognized, is pathognomonic of the disease. The symptom referred to is the track left by the female acarus in its passage through the substance of the epidermis—the *acarian furrow* as it has been termed. This presents the appearance of a curved, dotted line, under the surface of the epidermis, varying in length from the thirtieth to the third of an inch, and assuming the form of a comma, of a horseshoe, or of the letter S. It may be either white or of a grayish color. At one extremity of the furrow is a minute, rounded, opaque,

[Fig. 108.

Sarcoptes hominis, under surface.

Fig. 109.

Sarcoptes, male, upper surface.]

white elevation, the "*acarian eminence;*" from this, with a little address, the acarus itself may be extracted on the point of a pin.

Scabies rarely attacks the face or scalp.

Prognosis.—Scabies, if not submitted to suitable treatment, may continue indefinitely, but under the influence of appropriate remedies speedily disappears.

Diagnosis.—This is of unusual importance in this disease on account of its extremely contagious character.

In no other eruption is any mark on the skin produced that at all resembles the acarian furrow. To the practised eye the discovery of an acarian furrow is as conclusive a proof of Scabies as even the extraction of an acarus from the end of the furrow and an inspection of the insect through the microscope could be. In the adult the acarian furrows are to be sought for in the epidermis of the hands; but in the infant they are as visible on the feet as on the hands.

But, independently of the acarian furrow, there are certain peculiarities of Scabies which enable it to be recognized without any difficulty, in at all events the majority of cases.

The existence of a pruriginous eruption on the inner surfaces of the forearms, on the abdomen, and on the anterior and inner surfaces of the thighs, and a discrete vesicular eruption of the hands and feet, or a discrete pustular eruption of the hands, feet, and nates. A confluent vesicular or pustular eruption of the flexures of the knees and elbows, of the front

of the wrists, of the folds of the groins, and of the hollows of the axillæ.

An assemblage of such symptoms, or even of the first two of them, is usually enough to go upon, and a union of the first two occurs in most cases of Scabies.

Still it will sometimes happen that the acarian furrow is not to be met with; when this is the case it will generally be found (in cases which turn out to be nevertheless Scabies), that the patient has had previous imperfect sulphur-treatment. Whenever a case presents itself that has not had previous specific (sulphur-ointment) treatment, and yet presents no appearance of an acarian furrow under the scrutiny of a practised eye, presumption is strongly in favor of the case not being one of Scabies.

The pruriginous eruption may sometimes resemble prurigo senilis. The vesicular eruption may appear like eczema of the hands. The pustular eruption may resemble impetigo of the hands, or ecthyma of the nates, and the patches of eruption in the flexures of the joints, may resemble either eczema or impetigo.

Prurigo senilis, however, occupies chiefly the back of the shoulders, the outer surfaces of the upper arms, the loins, and the *outer* surfaces of the thighs. It *never* affects the fingers. The itching occasioned by it is far more severe than that of Scabies. Its minute scabs are larger and of a darker color than those which tip the papules of Scabies. The *pediculus corporis* is to be found on the underclothing.

In *eczema* of the hands the *dorsal* surfaces of the fingers are more affected by the eruption than their lateral surfaces.

Impetigo of the hands usually occurs in circumscribed patches.

It may be stated generally, that if an eruption has lasted two or three weeks, and still remains confined to one region, it is not likely to be Scabies, which is an eruption that soon becomes general.

Scabies generally commences on the hands or forearms; if the patient relate that his eruption began elsewhere, the probability is against its being Scabies.

Treatment.—Various remedies have been recommended for the treatment of Scabies. Stavesacre, iodide of sulphur, essential oils, mercury, iodide of potassium, benzol, and a host of others; but the remedy that is generally employed is sulphur, and this substance has long been considered as the most efficacious agent that can be employed in the treatment of Scabies. It enjoyed this repute long before it was known that the efficacy of sulphur as a cure for the itch, depended on its poisonous effect on the acarus, and its reputation as an "itch-specific" is as great in the present day as it ever has been. Several ways of administering it have been proposed; some give it internally, some internally and externally, but most are agreed that it is necessary only to administer it externally. As to the extent of surface over which it should be applied, differences have arisen; some authorities consider that its application should be limited to the regions where the acarus is visible, viz., the feet and hands. But the balance of opinion is justly in favor of applying the sulphur to every part of the skin that is liable to be affected by the eruption of Scabies. The mode of applying the sulphur has been a matter for discussion; some prefer it as a fumigation and some as a lotion, but most apply it in the shape of ointment. The composition of the ointment has been a subject of debate. The Unguentum Sulphuris of the late London Pharmacopœia was composed of one part of sublimed sulphur and two of lard; this was an unnecessarily strong compound. The Unguentum Sulphuris compositum; of the same Pharmacopœia, contained a fifth part of sublimed sulphur, a fifth part of soft soap, a sixteenth part of white hellebore, and a two hundred and fortieth part of nitrate of potash; this was too irritating a compound. The Unguentum Sulphuris of the British Pharmacopœia consists of one part of sublimed sulphur, and four parts of benzoated lard. These are suitable proportions, but the ointment is more efficacious if precipitated be substituted for sublimed sulphur. The former is in a much more finely divided state than the latter, and the old objection to the employment of precipitated sulphur, viz., the very extensive adulteration of it with sulphate of lime (to the extent even of 50 or 60 per cent.), is no longer valid since the precipitated sulphur is now sold in a state of almost perfect purity. The length of time required for treatment by ointment made with the sublimed sulphur, and the relapses that occasionally take place even after a prolonged use of it, have led some observers to seek after means of rendering it more speedy and certain in its action. The plan which has met with most favor, is to mix with the ointment a small quantity of the subcarbonate of potassa; about a drachm to the ounce of the unguent. sulph. P.B. is the proper proportion. The potash, by softening the cuticle, promotes the action of the ointment. A preferable plan, however, in the estimation of the author, is to use a small quantity of the hepar sulphuris in place of the subcarbonate of potash. A very efficacious remedy is the "Balsam of sulphur," a solution of sulphur in warm olive oil.

Glycerine is used in the place of lard as a vehicle to mix the sublimed sulphur with, but lard is for many reasons a far better substance for the purpose than the at present somewhat overrated glycerine.

Whatever form of sulphur ointment be used, the following rules should be observed in the treatment of Scabies.

Before applying the ointment, every part of the body excepting the head and face should be thoroughly washed with soap and water. For infants and young children, mild (neutral) soap should be used, but for adults, strong (alkaine) soap is necessary, the "*best*" "soft soap" answering the purpose very well.

After a thorough soaping of his skin, the patient should take a warm bath, remaining in it for about half an hour.

On emerging from his bath he should be thoroughly dried with warm towels, and then the ointment should be rubbed well in over every part of him, excepting only his head and face.

After he has been thus thoroughly anointed, he should put on linen or cotton, not flannel, underclothing next his skin, and keep the same underclothing on for two days and two nights without change. At the end of this time the ointment should be reapplied in the same manner, and with the same preliminaries as before.

If the ointment used be an efficacious one, and the treatment be energetically pursued, two or three applications will suffice to eradicate thoroughly the disease.

When Itch has broken out in a family it is important that all the members of the family who have contracted it should be treated simultaneously, and that those who have apparently escaped contagion should be watched for at least a fortnight after treatment has been commenced with the others. For it should be remembered that the disease has its period of incubation, and that the freedom from eruption of a person who has been very recently exposed to the contagion of Scabies, is no proof that he has not contracted the disease. It will be obvious that the popular plan of submitting to treatment only such children of a family as are suffering from the complaint, and then after they are well, of finding out that the disease has become sufficiently developed in another child to demand interference, is merely to perpetuate the disease indefinitely in such a family.

PHTHIRIASIS.

Synonym.—Louse-disease ; Maladie pédiculaire ; Die Läusesucht ; Morbus pediculari s.

The eruption produced by this parasite has already been described (under the heading of Prurigo) by the title of *Prurigo senilis*. It remains to be stated here that the pediculus corporis is not always easy to be found, and this is probably the reason why this parasite is not generally supposed to play the important part in the causation of cutaneous disease that the author's researches have led him to credit it with. On stripping a person affected with Prurigo senilis, it would not occur to any one who was unaware of the fact that the disease was produced by a pediculus. The pediculi are rarely numerous enough to arrest the eye, and more than this, even a careful scrutiny of the skin, including in the survey the parts of it that are most affected with eruption, will, in the majority of cases, fail to detect the presence of the parasite ; not even a *nit* is to be seen on any part of the skin or on any of the hairs growing from it. Now the pediculus capitis and the pediculus pubis—in cases when the insect itself is not easily to be found—may always be readily detected by means of the nits attached to the hair of the part they inhabit. It is not to be wondered at, then, that the part played by the pediculus corporis should have been so often overlooked. The parasite lives, not on the skin, but on the underclothing,[1] and it deposits its eggs neither on the skin nor on the hair, but on the underclothing. It is on the inner surface of the undermost article of clothing, whatever it may be, that the parasite is to be sought for, and here it is not always very easy of discovery. As already stated, the pediculi are rarely to be found in numbers ; a very few of them are capable of causing very severe irritation. A careful investigation of the patient's shirt may lead to no result, and yet his disease may be due solely to the pediculus. The parasite nestles in the "gathers" or folds of the shirt ; these are most numerous in a man's shirt at below the back of the collar of the shirt, and hence it is that in men the disease is usually most severe on the back of the shoulders, and always more severe on the shoulders than on the chest. In women (whose under-garments are arranged differently) the eruption is commonly as severe on the breast as it is on the back of the shoulders. At and below the waist, where the shirt is again thrown into folds, the pediculus again establishes himself, and accordingly the loins and upper part of the thighs are also common situations of the disease. The nits of the pediculus are also to be found in the same situations, but occasionally a larger cluster of them is to be found at some other part of the shirt.

The pediculus corporis affects men and women indifferently, and is to be met with in persons of all ages, but it more commonly infests adults than children, and is commoner with aged persons than with adults.

[1] It is, of course, not to be understood from this that it does not *feed* on the skin. It lives upon blood just as the flea does.

Pediculus Capitis.

Synonyms.—Head-louse; Pou de tête; Kopflaus.

This parasite occupies only the hairy scalp, and gives rise to eruptions of the scalp and of the neighboring skin. It lives in the hair. The pediculus corporis, as we have just seen, lives in the underclothing. But although it inhabits the hair of the head, it never invades the hair of the whiskers, beard, moustache, eyebrows, axillæ, or pubes, all of which situations, however, are liable to become infested by another kind of pediculus. The favorite habitat of the Pediculus capitis is the *occipital* part of the scalp; here it is always to be found in greater numbers than at any other part of the scalp, and here it is (in cases where the nature of a scalp-eruption may become a question) that evidence of the presence of the pediculus should be sought for. In cases where the hair is thick and the pediculi being few are therefore not immediately visible, their presence may at once be discovered by the existence of *nits* (the ova), sticking in numbers on to the hairs. The nits are readily to be distinguished from scurf by their oval outline, and their firm attachment to the shaft of the hair. They are to be found deposited in rows on the hair, and are sometimes arranged so closely as to give the hair a moniliform appearance. In children the Pediculus capitis is of far more common occurrence than it is in grown-up persons. In the child the eruption produced is generally *impetigo* of the scalp. Some writers who admit that the Pediculus capitis may be concerned in the production of impetigo of the scalp offer no suggestions for distinguishing between the impetigo arising from this cause, and constitutional impetigo, and are evidently unaware of any difference existing between the one and the other.

Some appear to think that impetigo granulata is the particular eruption that is caused by the head-louse. The author's researches have, however, shown him that the essential difference between the constitutional and the parasitic eruption is, that while the former almost invariably affects the anterior half of the scalp more severely than the posterior half, the parasitic eruption is always more developed over the occiput than it is at any other part of the scalp.

It must be remembered, however, that the presence of pediculi on the head of a child by no means invariably produces an eruption of impetigo. It is not a rare thing in public practice to meet with children whose heads are so thoroughly infested with pediculi as to lead to the inference that the latter are inhabitants of old standing, and yet there is often no eruption of the scalp except a scanty pruriginous one; the patient states that he experiences scarcely any irritation, and his parents say that he scarcely ever scratches his head.

Pediculi are less commonly to be met with on the heads of grown-up persons than they are in children, and either in men or in women their presence less commonly provokes any eruption (further than a scanty pruriginous one). The author has observed that the eruption commonly produced in adults is *not* an eruption of the scalp. The portions of skin most affected are those that are covered by the depending hair of the scalp, and the eruption is abruptly limited above by the margin of the scalp, and below by the ends of the depending hair. The character of the eruption is generally purely lichenous (circumscribed lichen), but it sometimes, though very rarely, assumes the form of eczematous lichen.

The situations occupied by this lichenous eruption are the temples, the ears, and the upper part of the back of the neck.

Pediculus Pubis.

Synonyms.—Crab-louse; Morpion; Filzlaus.

While the pediculus capitis may be considered as more especially the pediculus of children, and the pediculus corporis as the pediculus of old persons, the Pediculus pubis may be regarded as the pediculus of adolescents.

The pediculus corporis, as we have seen, attacks parts of the surface that are comparatively hairless, and appears to avoid those parts of the skin that are thickly covered with long hair.

The pediculus capitis and the Pediculus pubis, however, attack only such portions of the skin as are pretty thickly covered with hair. The pediculus capitis, as we have already learnt, limits itself to the hair of the scalp. Now all the rest of the longer hair of the body is the domain of the Pediculus pubis, viz., the pubic hair, the hair of the abdomen and chest, the hair of the axillæ, the beard, whiskers, moustache, eyebrows, and eyelashes. In the child the habitat of the crab-louse is limited to the eyebrows and eyelashes. A case of this kind lately came under the author's observation. The stronghold of the Pediculis pubis in the adult is the pubic hair; here it is always found in greater numbers than it is elsewhere, and here it is that it makes its first appearance.

The pediculus capitis, as we have seen, lives on the hairs, and deposits its eggs on the hairs; the pediculus corporis lives on the clothes, and deposits its eggs on the clothes. Now the Pediculus pubis

lives on the skin and deposits its eggs on the hair. The flat crab-like insect lies closely attached to the skin, and, if any attempts be made to detach him, he immediately digs his claws into the epidermis, and anchors himself so firmly to the skin, that it requires the exercise of some force to pull him off. The pediculus capitis crawls about the hairs, nestling between them; accordingly we find its ova deposited as often near the free ends of the hairs as near their roots. But the ova of the Pediculus pubis, which keeps close to the skin, are always deposited on the hairs very near to their roots.

The eruption provoked by the Pediculus pubis is a pruriginous one. It is often so severe as to simulate prurigo senilis,

[Fig. 110.

Pediculus pubis, with ova adhering to a hair.]

but the situations occupied by the eruption, corresponding to the habitat of the Pediculus pubis, the discovery of that insect on the skin, and the presence of nits on the hair, will always suffice to avert any confusion of the one with the other.

Prognosis of Phthiriasis.—Louse-disease in either of its three forms may last indefinitely if unchecked by appropriate means, but if recognized and submitted to suitable treatment it may always be speedily remedied.

Treatment of Phthiriasis. — Various remedies are used, all having for their object the extermination of the pediculus. Amongst these may be mentioned the powder of staphisagria seeds, the powder of the flowers of the Pyrethrum album, or or of the Pyrethrum roseum, olive or almond oil, sulphur in the shape of fumigation or ointment, mercury in aqueous solution, as a fumigation or in ointment, turpentine, the various essential oils, etc.

Of the "powder" of staphisagria seeds it may be said that it is at best but a clumsy contrivance. The seeds are incapable of being reduced to anything like powder. The most skilful drug-grinder cannot produce with them any better result than a coarse meal, much like linseed-meal, an utterly unmanageable application for the purpose, unless, indeed, a poultice were made of it. Finding that the meal contained a certain amount of oily matter, the author had the oil removed from a small quantity of the meal by percolation with ether, and found that the meal was capable of being reduced into a fine powder. He employed this powder in several cases of phthiriasis, and found it quite inert. On inquiring what proportion of oil had been extracted from the meal, he found that it amounted to as much as one half (by weight) of the meal; on making trial of the oil suitably diluted with olive oil, he found it as efficient as any remedy he has ever tried against phthiriasis. A cheap way of preparing the oil for application is to digest the seeds in melted lard and strain while hot. The filtrate is an ointment of the seeds of stavesacre. Two drachms of the bruised seeds should be used to an ounce of lard.

The powder of the flowers of the Pyrethrum is, in the author's experience, a much less efficacious remedy than the stavesacre.

Olive or almond oil acts only in a mechanical manner. By forming a film over the pediculus they occlude its spiracles, and so asphyxiate it. Unless applied very abundantly they are but uncertain remedies. Turpentine is objectionable on account of its strong odor and its irritating effect on the skin.

The essential oils are of uncertain efficacy.

Sulphur is not nearly so efficient a remedy as mercury, which is indeed on the whole a preferable remedy to any that have been mentioned. Those who are afraid to apply it over a large surface of skin for fear of producing its effects on the system can use the ointment of the oil of stavesacre, which is scarcely if at all less efficacious, but sometimes irritates the skin. But such fears are groundless; it is not necessary to *rub in* the mecurial ointment; all that is needed is that it should be lightly *smeared* over the affected regions, and there is no occasion for using a strong ointment. The author, who has

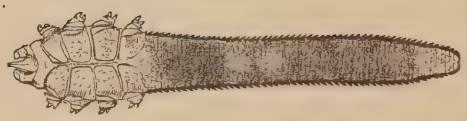
treated many hundred cases of phthiriasis by mercurial ointment, has not in a single instance occasioned any of the symptoms of mercurial absorption. The preparations that he generally employs are the Unguentum Hydrargyri Mitius of the Dublin Pharmacopœia. An ointment containing ten grains of the oxide of the mercury to the ounce, or citrine ointment mixed with an equal quantity of lard.

[*Acarus folliculorum*[1] (Demodex folliculorum) deserves passing mention, although not positively proved to be a cause of morbid symptoms or changes. It inhabits the follicles of the skin, especially upon the face in cases of acne. Sometimes a number, occasionally as many as fifteen or twenty, of these acari exist in a single sebaceous follicle. The head and thorax of this animalcule are consolidated, and furnished with four pairs of short legs; the abdominal portion is much longer. The cephalothorax constitutes about one-fourth of the length of the whole body, which, at the greatest, is about $\frac{1}{5}$ of an inch. Erasmus Wilson's hypothesis that this and other parasitic accompaniments of diseases of the skin are developed (without parentage) directly from morbid tissue elements, is contradicted by all the facts which have led to the rejection of *abiogenesis* (spontaneous generation) by nearly all modern biologists.—H.]

Fig. 111.

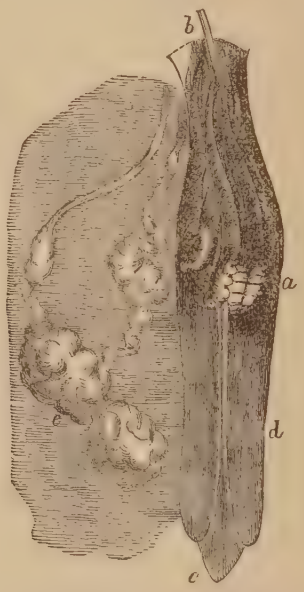
Acarus folliculorum.

Fig. 112.



Acarus folliculorum.

Fig. 113.



Group of Demodex folliculorum. *a.* Demodex. *b.* Hair. *c.* Its root. *d.* Follicle. *e.* Gland. (Cornil and Ranvier.)

SECTION XI.

The Vegetable-parasite Diseases of the Skin are—Tinea favosa, Tinea tonsurans, Tinea decalvans, Sycosis and Chloasma.

Tinea Favosa.

Synonyms.—The Honeycomb Ringworm; La Teigne (par excellence); Teigne lupineuse; Teigne jaune; Teigne à rayon de miel; Erbgrind; Honigwabengrind; Favus; Porrigo lupinosa.

Definition.—Tinea favosa, or (as it is more commonly called) Favus, may be defined as that disease of the skin which is occasioned by the presence of the vegetable parasite known as the *Achorion Schönleinii* in the substance of the epidermis and of the hair.

Causes.—(Predisposing.)—Childhood; poverty; the lymphatic temperament; scrofulous diathesis; the masculine sex. (Exciting.)—The presence of the *Achorion Schönleinii*.

Description.—The disease begins with itching and redness of the affected skin and with a furfuraceous desquamation of the cuticle. At the same time the hair loses its polish and becomes more or less brittle.

Soon small, isolated, dry yellow crusts, not larger than a pin's head, make their

[1] Steatozoon folliculorum of E. Wilson.—H.]

appearance. These, as they extend at their circumference and increase in thickness, become depressed at their centre; very often a hair passes through the middle of the depression These sulphur-yellow "Favus-cups" are pathognomonic of the disease. They are generally pretty numerous and are commonly surrounded by an areola of inflamed skin. Their size does not usually exceed that of a split-pea.

In this condition the disease has been called *Favus lupinosus* on account of the supposed resemblance of the small "cups" to the seeds of lupines. When sufficiently near to one another they may meet at their circumference, still retaining much of their original form. In such cases their rounded margin is pressed into a hexagonal shape, and the cup-like depression in the several crusts remaining, the surface bears some likeness to the cross section of a honeycomb. This appearance has given origin to the name of Favus.

After a certain time this honeycomb aspect is altered by portions of the cups getting detached, so that their depressions become obliterated. Their color, however, remains unchanged. In this stage the incrustation forms large irregular yellow patches (*Favus scutulatus*).

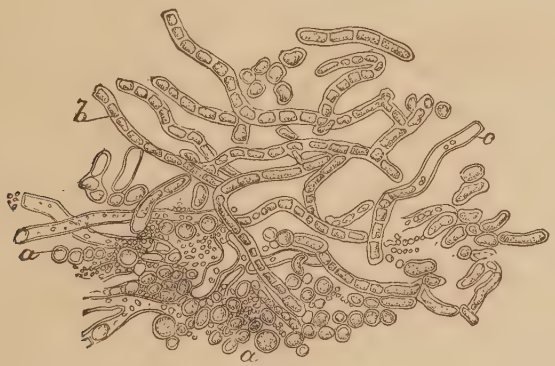
Later still the crusts lose their yellowness and become white, friable, and uneven, so as to resemble very closely in color and consistence, as well as in the conformation of their surface, the pieces of crumbling mortar that fall from old walls. In this state the disease is termed *Favus squarrosus*.

If in the early stage of the complaint one of the Favus-cups be carefully detached, there will be seen a smooth, shining, concave depression in the skin, somewhat red but without abrasion. At the same time it may be observed that the under surface of the cup is convex, and is much smoother and of a deeper yellow color than its free surface.

Coincidently with the development of the crust of Favus a further change beyond what has been already mentioned is undergone by the hair; the greater part of it falls off, and what remains loses color and becomes short and woolly.

The head of a person affected with Favus exhales a peculiar fetid odor which has been variously likened to that of mice,

[Fig. 114.



Achorion Schönleinii, treated with liquor potassæ. *a*. Spores. *b*. Spores connected with thallus. *c*. Articulated thallus. × 400. (Cornil and Ranvier.)]

of animal tissues undergoing maceration, or of the urine of cats.

Upon examination under the microscope the Favus-cups will be seen to be almost entirely made up of parasitic matter. This consists of (*a*) an amorphous homogeneous, finely granular *stroma;* (*b*) narrow sinuous ramified tubules containing molecular granules (the *mycelium*); (*c*) broader (*sporoforous*) *tubules* containing minute rounded cells, or elongated cells placed end to end so as to give the tubules a jointed appearance; (*d*) *spores*, some free, others joined end to end like a string of beads. The stroma and mycelium are found in greatest abundance towards the lower (convex) surface of the Favus-cup, while towards its concavity the cup consists chiefly of sporules. With the parasitic matter is a scanty admixture of epithelium cells.

If the diseased hairs be submitted to microscopical examination the filaments and spores of the *Achorion Schönleinii* will be found also in the substance of the stem and of the knot of the hair as well as in its root-sheath.

Besides the symptoms above described there are other phenomena which are to be regarded rather as accidental complications than as essential conditions of the disease. Thus not unfrequently the pustules of ecthyma or the crusts of impetigo are to be seen mingled with the Favus-

cups; and in the majority of cases the head is at the same time found swarmed with lice.

Favus attacks ordinarily the hairy scalp, but it is to be found also on any part of the skin that is furnished with hairs, however rudimentary these may be. It occurs also on the nails. Wherever it presents itself it exhibits the same characters.

Favus is in this country one of the rarest of the diseases of the skin. It is confined to no special period of life, but it appears most commonly between the ages of six and ten. It affects especially children of lymphatic temperament; the poor oftener than the rich. Its only exciting cause is contagion.

Prognosis.—When taken early Favus is a curable disease, but after it has existed for some time it occasions incurable baldness through atrophy of the hair-follicles, and is apt to leave behind it extensive cicatrices. When it has lasted for several years it produces general pallor, emaciation, and debility.

Diagnosis.—In no other eruption are the characteristic spores and mycelium of the Achorion Schönleinii to be found in the substance of the hairs and of the epidermis. Favus may, however, be mistaken for Impetigo, Psoriasis, Tinea tonsurans, or Tinea decalvans.

However, in *Impetigo* of the scalp (the disease with which Favus is most likely to be confounded) the crusts are of a brownish rather than of a yellowish (as in Favus lupinosus) or a whitish color (as in Favus squarrosus): they are not cup-shaped at the beginning, nor do they later assume a white powdery appearance. The odor exhaled by an impetiginous scalp, although often very offensive, has not that peculiar mousey quality that is characteristic of Favus. The hair is not so easily extracted. There are no bald spaces. The crusts are of a moister character. When there is (secondary) Impetigo complicating Favus, there is generally, at some portion or other of the scalp, an unmixed patch of eruption which exhibits, unmasked, the peculiar characters of Favus.

In *Psoriasis* of the scalp the incrustations are whitish but not powdery: they are stratified, and break up into scales, not into amorphous fragments. There are no cicatricial bald surfaces, the hair is not so easily extracted, and patches of psoriasis exhibiting their special nacreous sheen are to be found usually also over the knees and elbows.

In *Tinea tonsurans* there are no crusts and no absolutely bald patches. There are scurfy patches where the hair is broken off at the distance of about a line from the skin, but the scurf is neither yellow nor white but of a slate-gray color.

In *Tinea decalvans* there are no crusts, no scurf even; there are simply smooth polished circumscribed bald patches from which a fine down may on close inspection be seen growing.

Treatment.—The local treatment of Favus should be commenced by cutting all the hair that remains on the scalp so short as to leave only half an inch of its growth. This is to be done with the double object of facilitating the removal of the crusts and of making the scalp ready for the process of epilation. The next step is the removal of the Favus crusts. This may be facilitated by a preliminary poulticing so as to thoroughly soften the crusts. But the application of lint soaked in dilute acetic acid, and covered over with oil-silk to retard the evaporation of the volatile acetic acid, answers the same purpose more readily. The acetic acid permeates the epidermic tissue in which the Favus matter is imbedded, and by softening and swelling up the epithelial cells, makes the whole mass soft and easy of removal. The aromatic smell of the acetic acid, by neutralizing the offensive smell of the Favus matter, makes its use preferable to the poulticing of the Favus crusts, which is practically a very disgusting process.

After as much of the softened crust as possible has been scraped off, the head should be well washed first with dilute acetic acid and afterwards with soap and water, and it is then ready for epilation. Epilation or pulling out the hairs from the scalp is a comparatively easy process in cases of Favus, since the hairs are much less firmly implanted in the skin than they are in the healthy state, and they have not that extreme brittleness which renders epilation impracticable at first in the treatment of Tinea tonsurans.

The head of the patient may conveniently be rested in the lap of the epilator, or the patient may be seated while the epilator stands behind him. A common dressing forceps, furnished with a broad, straight-edged bill, is the most convenient instrument to use. The sensibility of the part about to be operated on should be diminished by means of the ether-spray and epilation rapidly performed by seizing three or four hairs at a time with the forceps and pulling them out in the direction of the slant of the hair at the part operated on. Care should be taken *to pull* the hair *not to jerk* it out, since on account of its brittleness it is apt to break unless traction on it be gradually made. Several sittings will be required to effect the epilation of the whole of the scalp. After a portion of the scalp has been epilated, it should be dealt with as directed in the description of the treatment, after epilation, of Tinea tonsurans. Sometimes a single thorough epilation, aided by as-

siduous application of the "parasiticide" remedies recommended in the treatment of Tinea tonsurans, is enough. But if, after the lapse of a few weeks the condition of the scalp appears to demand it, the epilation should be repeated.

The constitutional treatment of Favus consists merely in improving the general health in any way that may seem necessary. As a general rule cod-liver oil and steel are indicated.

Tinea Tonsurans.

Synonyms. — The Scurfy Ringworm; Boarding-school Ringworm; Teigne tondante; Herpes tonsurans; Tinea capillorum; Porrigo tonsurans; Herpes circinatus; Porrigo scutulata.

Definition.— Tinea tonsurans may be defined as that disease of the skin which is occasioned by the presence of the vegetable parasite known as the *Trichophyton tonsurans* in the substance of the epidermis and of the air.

Causes. — (Predisposing.) — Poverty; childhood. (Exciting.)—The contact of the spores of the Trichophyton tonsurans with the skin.

With regard to the causes above stated as predisposing to the disease, the first mentioned (poverty) is not more specially a favoring condition in this, than it is in other contagious diseases. The second however (age) exercises a special and peculiar influence in the causation of Tinea tonsurans. Thus it is in children only that the disease is met with affecting the scalp, whereas both in children and adults it occurs on other parts of the surface; although in any situation it is commoner with children.

Description. — The disease presents a different aspect accordingly as it affects the scalp or some other portion of the skin. When situated on the scalp it has been called distinctively Herpes tonsurans; when occurring elsewhere it is generally distinguished as Herpes circinatus.

Herpes circinatus appears in the form of minute rounded, red patches.

The rosy-red patches are slightly raised; their surface soon becomes rough and covered with a fine dry scurf; sometimes minute ephemeral vesicles appear on them. The patches rapidly increase in extent, retaining their original rounded outline; but as they spread they exhibit a disposition to heal at their centre, so that when they have existed for a few days they present the appearance of rounded patches of fading pityriasis bounded by a narrow lichenous ring. That is to say, their margin is decidedly raised, is of a rose-red color, is covered with a tolerably abundant furfuraceous desquamation, and sometimes with ephemeral minute transparent vesicles, while the area inclosed by it is of a fainter (pink) color, is scarcely, if at all, raised above the level of the healthy skin, is somewhat harsh, and is scantily covered by a very fine white scurf. At the centre of the patch the skin may approach still more nearly the healthy condition. There are usually several patches of variable size, some of which may attain a diameter of several inches. The patches are commoner on the exposed than on the covered portions of the body; thus in adults they generally occur on the backs of the hands, on the forearms, on the neck, or on the face; in women who are suckling they are apt to occur also on the breasts; and in children they are of common occurrence on the legs and shoulders as well as on the hands, arms, and face. The progress of the eruption is attended with more or less itching. The scratching and rubbing that this provokes is the cause of the disease being transplanted from one part of the surface to another.

Herpes tonsurans commences with more or less itching and redness of some part of the scalp. The affected spot is sometimes also slightly swollen; the hair growing from it loses its polish, becomes dull, and is more or less discolored; it becomes brittle so that it breaks off near to the root. This breaking off of the affected hairs at the distance of a line or two from the surface of the skin gives the patch an appearance as if it had lately been shaved (hence the name of the disease). If any of these hair-stumps be pressed on by the finger-tip their brittleness and want of elasticity become evident by their becoming permanently bent at an acute angle by the pressure, instead of springing back again, or at the most retaining only an almost imperceptible curve, as would be the case with healthy hair-stumps. The epidermis of the patch undergoes a furfuraceous desquamation, the hair-follicles become erect, so that a "goose-skin" appearance is given to the patch, the color of which becomes changed from a rosy-red to a faint slatish-blue. The hair-stumps as well as the intervening epidermic surface may sometimes be seen to be covered with a fine, white, extremely delicate, fluffy layer like the bloom on a peach. The margins of the patches are abruptly defined; sometimes, especially in lymphatic subjects, successive crops of vesicles, or of pustules, may make their appearance on the shorn patches, which accordingly assume more or less the appearance of patches of Eczema or of Impetigo. There are generally several patches of various size scattered on different parts of the scalp. Sometimes by the coalescence of several spreading patches extensive irregularly-shaped shorn surfaces are formed.

If by tweezers it be attempted to pull out one of the hair stumps, it will be found that the stump is so brittle that only a portion of it comes away, leaving the hair root in the skin.

Under the microscope this piece of the stump appears ragged at either of its ends. Instead of breaking with a clean fracture like healthy hair, the broken ends are digitated.

The structure of the hair is greatly altered. Its longitudinal fibres are separated, and the intervals filled with the spores of the Trichophyton. On the surface of the hair are clusters of the same spores. The piece of hair looks something like a bundle of sticks with a number of cherries sticking in clusters to its sides and ends, and stuffed here and there into its interstices.

The spores of the Trichophyton are rounded, have a well-defined outline, and measure about the $\frac{1}{3000}$ inch across.

In the earlier stages of the disease, when the hair has not yet become so brittle as to make it impossible to extract the root, it can be ascertained that the knob of the hair as well as its root-sheath is invaded by the spores of the Trichophyton.

[Fig. 115.

Trichophyton tonsurans. *a*. Spores. *b*, *d*. Filaments of mycelium, of short articulations. *c*. Filaments of mycelium of long and brilliant articulations. *e*. Cells of the dermis. × 400. (Cornil and Ranvier.)]

In "Herpes circinatus" the spores are most readily discoverable in the epidermic scurf. By some writers it is believed that the Trichophyton attacks the hairy part of the face of the adult male, whiskers, eyebrows, moustache, and beard, giving rise to the disease known as sycosis, and that it attacks the hair of the axilla, and also the pubic hair of the male and the female, giving rise to a pustular eruption. However it is admitted by those who hold such views that the parasite is very difficult to discover in such cases, and that the eruption is totally different in kind from what is produced by the same parasite on the scalp. These difficulties are got over by assuming that the disease as seen on the scalp is generally in an early stage, whereas on other hairy parts it gets rapidly through its earlier stages, and so comes to present itself commonly in the third stage, and this is an advanced condition that it but rarely attains on the scalp. The difficulty of finding the parasite is accounted for by assuming that it is destroyed by the discharge of the pustular eruption that it provokes. These views, as may have already been guessed, are not shared by the author.

Diagnosis.—"Herpes circinatus" may be mistaken for Pityriasis, Lichen (circumscriptus), Psoriasis (circinata), or Favus. But the patches of *Pityriasis* are not evenly rounded, their redness is of a tawny rather than of a pink or rosy kind, they have not a raised margin, and their centre presents the same appearance as their circumferential part.

In *Lichen circumscriptus*, the patches are less regularly circular, the scales thicker and more harsh, and the centre of the patches as rugous as their outer portion; moreover, the patches spread much more slowly.

In *Psoriasis circinata*, the scales are much larger and thicker; they have a nacreous sheen; the raised ring is much broader as well as more prominent; the

reddened skin has a tawny hue; the inclosed area is either sound or exhibits only a tawny yellow, not a pink stain; the rings enlarge far more slowly.

Patches of *Favus* are not very likely to be mistaken for those of "Herpes circinatus," but a microscopic examination of the scales might lead to error unless it be remembered that the sporules of the parasite that produces Favus (the Achorion Schönleinii) are much larger and have more of an oval shape than those of the Trichophyton. The diagnosis between Herpes circinatus and any other eruption will always be assisted by a microscopical examination of the scurf.

"Herpes tonsurans" may be confounded with other diseases of the scalp, for instance with Pityriasis, Psoriasis, Impetigo (granulata), Tinea decalvans or Favus.

[Fig. 116.

Hair from a case of Tinea tonsurans, loaded with spores.—(McCall Anderson.)]

But in circumscribed patches, either of *Pityriasis*, *Psoriasis*, or *Impetigo*, occurring on the scalp, the hair of the affected surface, though often more or less thinned, is never broken off uniformly (as in the case of "Herpes tonsurans") at the distance of a few lines from the surface of the skin. The hairs, if pulled at, come away entire, root and all. The patches are not evenly rounded. The hairs do not present the microscopical appearances characteristic of "Herpes tonsurans."

In *Favus* the incrustation, instead of being scanty, slate-powder-colored, and bran-like, is abundant, thick, and of a bright sulphur-yellow color; the hairs on being pulled come out readily by their roots—indeed, more readily than healthy hairs—and it may then be seen that their bulbs are much thicker than is natural. A microscopical examination of the hair will clear up any doubt.

Prognosis.—Tinea tonsurans, if it be left to itself, or if it be treated ineffectually, may continue for a very great length of time; for instance, it occasionally happens that cases of two or three years' duration come under notice. After very long continuance the disease is apt to occasion permanent baldness by producing atrophy of the hair-follicles.

In *Tinea decalvans* the patches are completely bald, that is to say, there are no hair stumps; there may be a few colorless downy hairs on the bald patches, but these are almost invisible to the naked eye. The patches are perfectly smooth and polished; they are of a dull white color.

Treatment.—In "Herpes circinatus" but little treatment is required. Washing the patches with a diluted solution of acetic acid (the acidum aceticum, Ph. Br., answers very well), or with a little soft soap, and drying afterwards with a rough towel, is sufficient. Common black writing ink is the popular remedy, and the acetic acid it contains makes it a very efficient one. The *modus operandi* of these remedies is that they dissolve off the semi-adherent scurf, as well as the superficial layers of the cuticle, and so detach with the cells the parasitic growth that thrives on them. Mercurial ointments of various kinds, such as the white precipitate ointment, the nitric oxide of mercury ointment, the citrine ointment, and others are also efficient remedies. [Tar ointment will generally be successful.—H.]

In "Herpes tonsurans" far more care than is needed for "Herpes circinatus" is requisite to obtain a good result.

Some authors praise the effect of a solution of sulphurous acid, the destructive influence of that gas on the lower forms of vegetable life being the reason of its employment. The solution is prepared by adding vinegar to a solution of hyposulphite of soda, a salt largely manufactured for the use of photographers, and much easier to obtain than the sulphite. The resulting solution of sulphurous acid is applied by soaking pieces of lint in it, laying them on the affected places and covering them with oiled silk, to prevent the escape of the gas. This ingenious plan, however, is, in the author's experience, far from being an efficacious one. In spite of the covering of oiled silk the volatile sulphurous acid is dissipated so rapidly, its escape being favored by the warmth of the head, that in a surprisingly short time after the application of the solution the suffocating odor of the gas is no longer perceptible, and very shortly not the least trace of it can be smelled. The good done by the solution is, the au-

thor believes, entirely due to the excess of acetic acid used in its preparation, and to the precipitated sulphur that is formed by the decomposition of the liberated hyposulphurous acid (into sulphurous acid and sulphur).

Epilation, aided by the use of "parasiticides," is advocated very earnestly by some writers. They all, however, admit that until the disease has begun very obviously to improve epilation is practically impossible, on account of the extreme brittleness of the hairs, but nevertheless advise that the ceremony should be performed regularly from the commencement, until later on it becomes really possible to extract the roots of the hairs. The object of epilation is to remove the diseased hair roots which are not very accessible to the reach of local applications, and thus to render possible the penetration of "parasiticide" remedies into the hair follicles. But the object of stimulating epilation by pinching off small pieces of the projecting brittle hair stumps is not quite so evident.

In all cases the root of the hair (the part within the follicle) is less diseased than the shaft. It is better, therefore, if epilation be aimed at, to improve first, if possible, the state of the stump of the shaft, so that it may regain enough of its natural tenacity to bear the strain on it necessary to extract the root. This end is best attained by the use of some agent which is capable of penetrating the substance of the hair and destroying the parasite. These conditions are found united in a solution of the hepar sulphuris, a substance procured by fusing together equal parts of sulphur and of dry carbonate of potash, the result of which process is the formation of pentasulphuret of potassium and hyposulphite of potash. The pentasulphuret of potassium exercises the same solvent effect on the tissue of the hair that is produced by the oxide of potassium, or potash, and carries the dissolved sulphur into every part of the diseased shaft, penetrating even some distance into the root of the hair, as well as into the equally diseased root-sheath. Since the hepar sulphuris is as irritating to the skin as potash, the solution to be used should be of moderate strength.

After the patches have been daily painted with the solution for two or three weeks it will be found that effective epilation can be practised, and then other remedies requiring less care in their use are admissible, for example, sulphur ointment. This should be made of precipitated sulphur, and should contain also a small proportion of the hepar sulphuris, or citrine ointment may be used. A favorite remedy is the nitric oxide mercury ointment, but it should be made with oxide prepared in the wet way. In all cases during the course of treatment the head should be daily well washed in order to prevent as much as possible the formation of fresh foci of the disease. When epilation becomes practicable it should be performed by means of a broad forceps, having a straight edge. The contingent surfaces of the forceps should be roughened, so that they may "bite" the hair. The sensibility of the surface about to be operated on should first be deadened by means of the ether-spray, and then, the head of the patient being steadied by the hands of an assistant, the patch should be rapidly and thoroughly epilated. When the hair has again grown long enough to afford a good hold to the forceps the process of epilation should be repeated, the ointment being assiduously used in the interim, and so on until recovery has taken place. It is a good plan to persevere in the use of remedies even long after the disease has apparently completely disappeared, since unless every vestige of the trichophyton has been completely destroyed a relapse of the disease is certain to happen.

When the complaint occurs in lymphatic children, some general treatment is advisable. The bowels may require to be regulated, and the diet to be selected, and cod-liver oil and the syrup of the iodide of iron, or steel wine, may be indicated.

Of recent times, the Indian remedy known as Goa-powder (the pith of a leguminous tree found in the province of Bahia in Brazil) has been adopted in this country for the treatment of ringworm. The powder is used in the form of ointment, varying in strength from five to twenty per cent. The remedy is of undoubted service, but care must be taken to avoid the contact of it with the eyes.

Tinea Decalvans.

Synonyms. — Area; Alopecia circumscripta; Porrigo decalvans; Pelade; Phyto-alopecia; Vitiligo; Teigne pelade; Alopecia areata; the smooth Ringworm.

Definition.—A contagious disease produced by a vegetable parasite which, attacking the hair, leads to the formation of circumscribed, pale, smooth, bald patches.

Causes.— (Predisposing.) — Childhood; constitutional syphilis. (Exciting.)—The presence of the *Microsporon Audouini.*

Description.— The disease commences (usually on some part of the hairy scalp) with slight itching. The itching is confined to a limited spot, the hair growing from which may on examination be found to have lost its natural gloss, as well as its natural firmness of attachment to the skin, since on pulling at it it readily comes off. On examining, by touch, the corre-

sponding patch of skin, it may be ascertained that it is slightly indurated. Very soon the loosened hair falls off, and it may be seen that the disease occupies a small well-defined area, which is completely denuded of hair. On a cursory view the most striking peculiarities of the disease at this stage are the perfect baldness of the patch, which is smoother than the most closely shaven beard, the absence of any other notable change in the affected skin, and the abrupt manner in which the baldness ceases at the margin of the patch, the hair immediately surrounding which is as thickly set and as long as on any other part of the scalp.

On examining more closely, however, it may be found that the skin corresponding to the bald patch is slightly thickened and indurated, is somewhat paler than the surrounding skin, and has something of a polished appearance, and furthermore, that the hair immediately around the patch has lost its gloss, and may be easily pulled out. The baldness, too, is not so absolute as it at first sight seems, for the hair that has been lost becomes very speedily replaced by a scanty crop of short, light-colored, thin, silky filaments, which resemble the fibres of cotton or rather of fine wool, and may require a lens for their detection, while towards the margin of the patch short, thick, club-shaped hair-stumps make their appearance. These stunted hairs vary from the $\frac{1}{16}$ to the $\frac{1}{8}$ of an inch in length, and are mostly of the same color and thickness as the healthy hairs, except at their free extremity, which is always of a much darker color as well as much thicker than the lower portion of the stump.

[Fig. 117.

Hair from a case of Alopecia, showing Spores of Microsporon Audouini. × 250. (Cornil and Ranvier.)]

If a hair be taken from part of the skin where the disease is in active progress, *e. g.*, from the edge of a bald patch which is spreading, it will probably exhibit (under the microscope) traces of the Microsporon Audouini. The hair should be moistened with a dilute solution of caustic potash and viewed through a "quarter" object-glass. The spores of the Microsporon Audouini, which are smaller and less numerous than those either of the Tricophyton tonsurans or of the Achorion Schönleinii, may be seen scattered in the form of minute spherical granules in the substance and on the surface of the diseased hairs.

The disease may spread from only one, or from as many as ten, or even twenty independent centres. As a rule, when it first comes under observation, there are at least three or four separate patches, varying in size from that of a threepenny-piece to that of a crown.

Varieties. — The disease may assume either of two phases. In the one variety (for which the author proposes the name Alopecia nummulata) the patches increase but slowly, so that they may be several months attaining a diameter of one or two inches, and their form is evenly rounded, being either oval or circular.

In the other (much rarer) kind, which may be distinguished as Alopecia serpiginosa, the progress of the disease is more rapid, and its extension takes place in a less regular manner; the bald places speedily spread so as to form large irregularly-shaped patches with sinuous margins.

Occasionally the two varieties may coexist in the same individual.

The nummulated variety may sometimes, by the coalescence of two or three patches, simulate in some degree the serpiginous form; but even when this happens the margin of the compound patch will exhibit only three or two regular curves corresponding to the outlines of the patches which compose it, and may be readily distinguished from the regular border of the serpiginous variety. In the former case, too, the patient's account of himself will prove that the disease has remained for some time in the condition of separate rounded patches before the irregular patch was produced. The distinction, which may perhaps appear of but small importance, is of value in determining the prognosis which, with reference to the chances of permanent baldness, is much less favorable in the serpiginous than in the nummulated variety. Indeed, in the former, the progress of the disease is sometimes so rapid and extensive that in a few months from its first appearance the patient may be left for the rest of his life without a single hair on any part of his body.

Tinea decalvans, when left to itself, may terminate either in (spontaneous) recovery, or in incurable baldness; the former result, which is comparatively

rare, occurs more frequently in the nummulated than in the serpiginous variety. The approach of recovery may be recognized by an arrest of the extension of the disease, by the cottony fibres gradually acquiring more and more the characters of healthy hair, that is to say, becoming coarser, longer, and of a darker color, and by the diseased skin regaining its natural color and losing its induration.

When permanent baldness has been produced the induration of the skin disappears, and it regains almost if not completely its natural color, but instead of remaining at its original thickness and consistence it becomes thinned and atrophied. On the scalp and other parts where the hair is naturally coarse and thickly set, this alteration becomes very manifest. In this condition of the skin the cottony fibres become very fine and scanty or may be altogether wanting.

In either of its forms the disease is commoner with children than with adults. In the latter it often coincides with recent constitutional syphilis, as if the modification of the system produced by the syphilitic virus offered a favorable soil for the development of the disease. It will be understood that what is meant here is the veritable Tinea decalvans, as distinguished either from general (syphilitic) thinning of the hair, or the bald cicatricial patches that are left by some syphilitic eruptions.

Diagnosis.—Tinea decalvans may be mistaken for Vitiligo, Tinea tonsurans, Tinea favosa, Senile Alopecia, Syphilitic Alopecia, or the temporary loss of hair that is often consequent on various acute illnesses.

But in *Vitiligo*, although the hair be discolored, it retains its usual length, as well as its natural degree of coarseness. There is no induration of the skin, and the paleness of the patch itself is made up for by the unnaturally deep color of the skin in its immediate neighborhood, and, furthermore, the disease does not exhibit that marked predilection for the scalp which is noticeable in Tinea decalvans.

In *Tinea tonsurans* the skin is darker than natural, having a grayish tinge; the surface, which is scurfy, has a "goose-skin" appearance, the hairs are not absent, but merely broken off close to the skin.

In *Tinea favosa* the presence of small yellow cup-shaped incrustations, or of the larger white powdery crusts, and the inflamed condition of the skin itself, will usually suffice to avoid error.

In *Senile* and in *Syphilitic Alopecia* the baldness is diffused, not circumscribed; there is a general thinning of the hair, and no formation of circumscribed bald patches. The same remarks apply to the baldness produced by pregnancy, or by acute general disease.

The bald patches which are caused by cicatrices, resulting whether from injury or disease, may be distinguished by the cicatricial character of the integument, and by the history of the case.

Prognosis.—In the *nummulated* variety it is generally favorable as regards the prospect of ultimate recovery, although if the disease be of long standing, a period of several months may sometimes be required to restore the hair to its original condition. In the *serpiginous* variety the prognosis will be doubtful; indeed, the author has met with cases in which, notwithstanding that the patient had had from the first the advantage of eminent advice, complete and permanent baldness had ensued. In either variety the probability of speedy recovery will be less in proportion to the previous duration of the disease, the size of the patches, the fineness and scantiness of the cottony filaments, and the atrophy of the scalp.

Treatment.—The administration of arsenic internally has been recommended for this disease, but the author's experience of it is not at all such as to induce him to recommend it here, as of any, even the slightest, use. By many the effect of steel has been praised, but, although of unquestionable service in the temporary baldness following acute general disease, it is quite incompetent *per se* to arrest the progress of Tinea decalvans, and it is doubtful whether its employment is of any advantage. This much, at all events, may be said, that the usual indication for steel, viz., pallor, is as often absent as present in this affection.

The local applications that are in good repute for the healing of bald patches, are:—

Ointment of tar (℥ij to the oz.), the Unguentum Cantharidis, the Unguentum Creasoti. Ointment of the Huile de Cade (℥j to the oz.). The Linimentum crinale (which is composed of Cantharidine gr. j. Spirit. Rectif. ℥iij. Ol. Ricini ℥j). The Cantharidine tissue, or the Capsicum tissue (sold under the name of Sinapine tissue). Alcoholic solutions of the various essential oils, in the proportion of ℥ss of the oil to ℥j of rectified spirit. Ointment of the Sulphur præcipitatum (℥ij to the oz.). The Unguentum Hydrargyri mitius of the Dublin Pharmacopœia. The Unguentum Hydrargyri Iodidi Rubri, diluted with three times its bulk of simple ointment. An ointment of Turbith-mineral (gr. xv to the oz.). An aqueous solution of corrosive sublimate (gr. ij to the oz.), and others.

All that have been mentioned, it will be observed, are either "parasiticide" or "stimulant," while many of them possess both of these properties. There is no

doubt but that stimulation is an essential part of the process of cure, and, according to the author's experience, it is better that the stimulation should be slight and continuous than violent and intermitting.

Sycosis.

Synonyms.—Chin-welk; Herpes pustuleuse; Mentagre; Felgwazen; Phyma; Mentagra; Tinea sycosa.

Definition.—Sycosis is a disease of the hairy part of the face, caused by the growth of the *Microsporon mentagrophytes* in the root-sheaths of the hair, and characterized by considerable cutaneous and subcutaneous inflammation, and the development of pustules and nodular swellings.

Causes.—(Exciting.)—Contagion. (Predisposing.)—Adult or advanced age and the male sex.

Description.—The eruption is confined to the hair-covered portions of the face. It is consequently only met with in adult males, or (very rarely) in such adult females as are provided with more or less of a beard. It exhibits a special predilection for the *chin*, whence its names Mentagra and Chin-welk. The disease commences with a sensation of heat and tingling of the affected surface, which soon becomes reddened, scurfy, tender, and somewhat swollen. Soon pustules and tubercles of a peculiar kind are developed on the inflamed patch.

The pustules are very large, and are purulent only at their summits, the indurated acuminated base, which may attain the size of a nut, forming the greater part of the pustule. The pustules are sometimes isolated, but are generally arranged in clusters.

The tubercles, which may attain a size equal to that of the pustules, occur in circumscribed groups, those of the same group running into one another, and forming a raised nodulated patch. The surface of this patch soon becomes excoriated, and secretes a muco-purulent fluid, which concretes into a thin dirty-gray scab. On detaching and removing this scab, a moist, glistening, coarsely nodulated red surface is disclosed, looking something like the inner part of a ripe green fig (hence the name Sycosis). The surface of a ripe mulberry is perhaps a better simile.

These circumscribed, raised, nodulated, moist scab-covered patches (*fungous ulcers* as they are sometimes termed) occurring about the chin, are very distinctive of the disease.

The pustules, or the tubercles, attain their full development within the space of ten days or a fortnight.

As might be supposed, so much acute inflammatory swelling of the chin is attended with considerable discomfort, and produces enlargement, and sometimes suppuration, of the submaxillary glands.

The hair of the affected surface soon becomes loosened, and falls, or is only maintained *in situ* by its roots becoming entangled in the crusts. When the crust is removed nearly all the hairs that it has entangled come with it.

Sycosis is in this country an extremely rare complaint, rarer even than Favus. On the continent, however, it is not rare.

Prognosis.—If submitted to suitable treatment Sycosis may be recovered from, but if left to itself it is likely after a long continuance to end in permanent baldness.

Diagnosis.—Sycosis may be mistaken for impetigo sycosiformis, for a vegetative or a tubercular syphilide, or for epithelial cancer.

Sycosiform impetigo, however, is a more superficial eruption. Its pustules are never so large, nor are they ever accompanied with so much infiltration of the skin and cellular tissue as those of Sycosis. It presents, so to speak, much less of a malignant appearance than Sycosis. There are no "fungoid ulcerations" in sycosiform impetigo. It exhibits no special predilection for the chin. On the contrary, it is commoner on the upper lip than elsewhere, and is very often limited to the hairy parts of the cheeks. On detaching the crusts of sycosiform impetigo, the entangled hairs do not come away with the crusts, but remain firmly attached to the inflamed skin, nor is any notable baldness of the affected surface produced by the eruption, unless the disease be of very long (several years) standing. Sycosis is contagious, impetigo not so. A microscopic examination of the hair growing from the inflamed skin may, in cases of doubt, be called in to aid the diagnosis. In arriving at a decision it should always be remembered that in this country an eruption of the chin is far more likely to be sycosiform impetigo than Sycosis.

Acne (indurata) may be readily distinguished from Sycosis by its not being confined to the hairy part of the face, by its tubercles being of much slower growth, by their containing a sebaceous core, and by the absence of "fungous ulcers."

The flat vegetative syphilide, or mucous tubercle, is apt to be mistaken for Sycosis because it is not uncommonly developed in the neighborhood of the mouth, and presents a raised raw surface covered with a crust. But the surface of the mucous tubercle is paler and is much smoother than that of the ruddy, coarsely-nodulated, fungous ulcer of Sycosis. Its margin often overlaps the constricted base—a condition never present in Sycosis. It is commoner at the angles of the

mouth and on the cheeks than on the chin.

The tubercular syphilide (the clustered non-ulcerating variety of which may be thought to have some resemblance to Sycosis) is far more slowly developed. Its tubercles either do not form a raw surface, becoming gradually reabsorbed without breach of surface, or if a raw surface be formed the crusts covering it are thick and dark-colored, and conceal, not a reddened nodulated fungous surface, but abruptly-limited sunken ulcers, with flat ash-gray floors. The tubercular syphilide is always accompanied by other symptoms of constitutional syphilis.

Epithelial cancer is a disease of far slower progress than Sycosis. It presents, it is true, like Sycosis, an elevated raw surface, but the circumferential is decidedly more elevated than the central part, and the surface is lobulated rather than nodular. The disease, when it occurs in the neighborhood of the chin, affects usually the lower lip.

Treatment.—The treatment of Sycosis is to be conducted on the same principles as that of Tinea favosa.

Chloasma.

Synonyms. — Liver-spots; Taches hépatiques; Crasses parasitaires; Danne hépatique; Leberflechte; Pityriasis versicolor; Maculæ hepaticæ.

Definitions.—A contagious disease produced by a vegetable parasite (the *Microsporon furfur*) which, attacking the epidermis, leads to the formation of more or less extensive, tawny-yellow, scurfy patches.

Causes. — (Predisposing).—Adult age; the tubercular diathesis; pregnancy. (Exciting).—The presence of the *Microsporon furfur*.

Chloasma scarcely ever occurs in children. Tuberculosis appears to be a favoring cause. The disease is apt to occur in pregnant women, disappearing often shortly after delivery. It has been supposed that wearing flannel is a cause of the disease; the great argument in support of this theory is the fact that the eruption ordinarily is limited to the parts usually covered by a flannel under-garment, viz., to the trunk and the upper parts of the arms and thighs.

The author has often met with Chloasma occurring in those who do not wear flannel underclothing, and in them the disease has been as strictly confined to its usual situations, as it is in those who wear flannel all the year round.

Description.—Chloasma, or as it is often called, Pityriasis versicolor, presents the appearance of variously-shaped stains of the skin, which may be of a yellow, a brown, a reddish, or even a black color. These discolored patches may be small, rounded, and distinct from one another, or larger and coalesced so as to form fantastic patterns, the outlines of which, although sinuous and irregular, are usually well defined. In other cases one large uniform patch may cover nearly half the body. The surface of the patches is slightly raised above the level of the skin, and exhibits a mealy desquamation. This scurfiness, though it is much less conspicuous than that of Pityriasis proper, is important as a means of diagnosis. According to the author's observation it is always most perceptible at the margin of the disease. When not evident over the general surface of a patch, it may be rendered so by scraping the skin lightly with the back of a penknife. On detaching the diseased epidermis the skin beneath is seen to be *reddened* as well as swollen. The epidermis itself is yellow. The disease commences as small scattered spots of about the size of a pin's head; these slowly spread till they meet and coalesce with one another.

Chloasma is seen most frequently on the anterior surface of the neck and of the upper part of the chest, and on the upper part of the back and arms; it is common, too, on the pubic region and the inner half of either groin. The author has remarked that it rarely affects the hollow of the axilla, or the lateral surfaces of the chest or abdomen, even when most extensively spread over the anterior and posterior surfaces of the trunk.

Chloasma is more commonly a disease of adult age. It is seen often in the phthisical. It follows a chronic course. It depends essentially on the presence of the *Microsporon furfur* in the substance of the epidermis. If a portion of the epidermis scraped off from the diseased surface be moistened with dilute acetic acid or a solution of potash and placed under the microscope, the cryptogam will be seen to consist of (*a*) clusters of cells (the sporules), and (*b*) ramified tubules (the mycelium). The various lines of different patches of Chloasma in the same individual depend on the varying quantity in which the Microsporon furfur is present at different parts of the surface. The itching that attends Chloasma is usually slight, but it is occasionally severe.

Chloasma is apt to occur in pregnant women, disappearing often shortly after delivery; singularly enough in such cases the face is the favorite locality of the disease. This Chloasma gravidarum must be distinguished from the Ephelis of the pregnant, which it much resembles in general aspect, but which is produced by an alteration in the pigmentary matter of the epidermis, and is attended neither with itching nor with desquamation.

Prognosis.—If untreated the disease continues indefinitely. But it yields readily to suitable treatment. It is, however, very apt to return after a time. When it occurs in pregnant females it may be expected to disappear shortly after delivery.

[Fig. 118.

Microsporon furfur. (McCall Anderson.)]

Diagnosis.—In no other eruption are the characteristic spores and mycelium of the Microsporon furfur to be found in the epidermis. Chloasma may, however, be mistaken for Ephelis, for Pityriasis, or for Vitiligo. But in *Ephelis* there is no itching and no scurfiness, in *Pityriasis*, although there is both itching and scurfiness, the scales are white. In *Vitiligo* the lighter patches inclosed by the darker stains are unnaturally white, whereas in Chloasma they are of the natural color. There is no scurfiness in Vitiligo.

Treatment.—Lotions of sulphurous acid are recommended in the treatment of this disease, but sulphurous acid is far too volatile an agent to be of much service. When exhibited in this shape lotions of dilute acetic acid are of service, they soften and detach the diseased epidermis and remove with it the parasite. Weak lotions of caustic potash or strong solutions of the subcarbonate of potash have a similar effect. Dilute lotions, or still better, weak baths, of corrosive sublimate are very efficient remedies. So are sulphur baths.

A very efficacious mode of treatment is the following: The patient first thoroughly soaps the affected skin; after this he takes a warm bath, and as soon as he has dried himself, scrubs the discolored surface with a flesh brush; he then rubs well in, over every patch of the disease, a weak mercurial ointment. This process is repeated every second day. This plan, which the author has employed pretty extensively, has the following advantages. By the first operation all the semi-detached scurf and much of the parasite is removed. By the second the remaining epidermis is thoroughly softened, so that by the third step the more superficial portion of it, with the parasite matter contained therein, is readily detached, and thus the more deeply seated portions of the fundus are laid bare to the immediate contact of the remedy. By this process patches that have existed for many years may be removed completely in about a week's time. An ointment of sublimed sulphur has been recommended, but the precipitated sulphur is a much more active remedy than the sublimed sulphur. If sulphur ointment be used, its efficacy is much enhanced by the addition of a small quantity of the hepar sulphuris.

Chrysophanic acid ointment has of late been used with considerable success in the treatment of Chloasma. Twenty per cent. ointment may be used for the purpose, special care being taken to keep the remedy away from the eyes. [Experience makes it appear that ten grains of chrysophanic acid to the ounce will be strong enough for its best action in this affection. —H.]

SECTION XII.

Foreign Diseases of the Skin.

Of the diseases of the skin that are foreign to this country[1] we shall describe the following: Elephantiasis Græcorum; Elephantiasis Arabum; Framboesia; Pellagra; and Malum Alepporum.

Elephantiasis Græcorum.

Synonyms.—Mal de S. Lazare; Mal rouge de Cayenne; Maladie de Jérusalem; Elephantenaussatz; Der knollige Aussatz; Spédalskhed (of the Norwegians); Leontiasis; Satyriasis; Lepra of the Arabs; Elephantiasis tuberculata; Lepra tuberculosa; Tsarath (of the Hebrews); Dsjuddam or Jusam (of the Arabians).

Definition.—Elephantiasis Græcorum is an extremely chronic general disease which is characterized at first by the development of tawny stains on the skin, the sensibility of which is either (most commonly) diminished or (less frequently) increased subsequently by yellowish-brown tubercles, and finally by ulcers which often extend deeply into the subjacent tissues.

As the disease progresses it is attended with considerable debility and mental dejection, and in most cases terminates fa-

[1 Except a few instances of Elephantiasis Arabum, the above-mentioned diseases are also foreign to the United States.—H.]

tally from ulceration of the bowels and colliquative diarrhœa.

Causes.—Greek Elephantiasis was formerly thought to be contagious. It has, however, long been satisfactorily ascertained that it is not so.

The predisposing causes of the disease are *hereditary transmission* and the *influence of special climatic conditions;* it is consequently endemic in certain localities. Climate appears to be a more essential cause than hereditary predisposition.

The exciting causes are uncleanliness, unhealthy habitation, intemperance, an unwholesome diet, debauchery, great fatigue, nervous affections.

The disease is commoner with men than with women; it is generally developed before puberty.

Description.—Generally, the first symptom of the disease is the appearance of small circumscribed stains, which, though usually of a tawny, are sometimes of a purple color. In negroes the stains are sometimes of a darker, sometimes of a lighter color than the unaffected skin.

Occasionally, however, the appearance of the stains is preceded for several weeks or even months by general symptoms: languor and a feeling of weight in the limbs; less commonly by feverishness.

The stains appear at first on the face, legs, and forearms. On the face (where they are often for some time confined to a limited space—the ears or the nose) they are accompanied with considerable swelling of the subjacent cellular tissue.

The sensibility of the skin corresponding to the stains is in all cases considerably altered; generally the sensibility is diminished, sometimes so much so that they may be pricked with a needle without the patient being conscious of it. But in some instances the sensibility is increased so that the least touch occasions the most vivid pain, producing a sensation which has been compared to that caused by a blow on the nerve at the elbow.

The disease may continue in this stage for several years, the stains after a time remaining stationary or continuing constantly to invade fresh regions.

At length small tumors take the place of the stains: they are of irregular shape and various size, ranging from the size of a pea to that of a walnut; their color is yellowish-brown or (sometimes) dusky-red; they are soft and shining. The face is the situation where they increase most rapidly and become most developed, so that the countenance at length presents a revolting and even hideous appearance—it becomes studded with irregular knobbed elevations, separated here and there by deep furrows—the skin is much hypertrophied and the subcutaneous cellular tissue considerably swollen—the brows are overhanging—the lips, ears, and nose enormously thickened—the eyebrows, eyelashes, and beard fall off, and the whole face is of a tawny brown or dusky hue—its dreadful deformity is rendered the more disgusting by a greasy film which lubricates the tubercles and gives the skin a shining appearance. From this hideous deformity of the face the disease has acquired its names. "Leontiasis," "Elephantiasis," "Satyriasis." The last of these names, which refers only to the disfigurement of the face, has given rise to the erroneous supposition that the sexual propensities are morbidly increased in this disease.

On the limbs the disease presents the same characters, but in a milder degree than on the face.

In the tubercular stage the alteration in the sensibility of the affected skin is usually more marked than in the antecedent macular phase.

But it is not only on the skin that the tubercles of Greek Elephantiasis are developed. They invade also the conjunctiva (ocular as well as palpebral) and the mucous membrane of the mouth, nose, pharynx, and larynx, so that sight and hearing are affected, smell and taste become greatly impaired, the voice becomes husky or extinguished, respiration more and more difficult, and the patient, weak and dispirited, loses all power of exerting himself.

The disease continues in the tuberculous stage usually for several years.

At length the tubercles inflame and ulcerate. Sometimes the ulcers are fungous and superficial, and produce and renew moist dark incrustations, which from time to time get detached. In other cases they eat deeply into the subjacent tissues. As the disease advances the internal organs become affected; the trachea and the ramifications of the bronchi, the œsophagus and the intestines, become the seat of albuminoid deposits, similar to those of which the tubercular elevations of the skin are mainly composed. In these situations, as on the skin, the deposit at length undergoes softening, and so ulcers are produced, and the disease terminates fatally with enteritis and colliquative diarrhœa.

The above description refers to what has been termed the tuberculated variety of the disease (Elephantiasis or Lepra tuberculata). Sometimes, however, the stains, in place of being succeeded by tubercles, are replaced by bullæ resembling those of chronic pemphigus; these, after breaking, leave sores. This latter variety is called *par excellence* E. or L. anæsthetica. The ulcers which, as in the other variety, often extend deeply, are covered with white scabs. The skin, at first extremely sensitive, gradually becomes

parchment-like and loses its sensibility, so that the greater portion of the surface may become affected with anæsthesia. The limbs become stiff and inflexible and the muscles atrophied. Ulcers encircle the fingers or toes, which become separated and drop off. Violent pains are felt in the limbs, and the disease ends fatally with diarrhœa and sometimes tetanic spasms.

Sometimes the two varieties coincide in the same individual, so that the face may be affected with the tuberculated and the limbs with the bullous eruption.

The course of the disease is usually spread over a long period—ten or even twenty years.

Respecting the nature of the disease it has been attributed by Danielssen to a dyscrasy consisting in an excess of albumen and fibrin in the blood.

Although differing widely in many particulars from syphilis, scrofula, and tuberculosis, it resembles them in so far as it is the result of a special diathesis, which is manifested by a depravation of the general health and the deposition at various parts of the body of a lowly organized material which after a time softens and breaks down. The lesions of sensibility, which are so characteristic of this disease, are attributed by some to the deposition of albuminous material on the surface and in the substance of the nervous centres, and by others to a similar deposit in the sheaths of the nerves.

Elephantiasis Græcorum is endemic in all tropical latitudes, and also in some high northern latitudes, viz., in some parts of Norway and Sweden. In this country it is occasionally met with in foreigners who are natives of countries where the disease is prevalent, or in Englishmen who have long resided in such countries. Several centuries ago it was endemic in England and in many parts of Europe, whence it has since disappeared. Cases have occurred in persons of English parentage but born in a country where the disease prevails, but who nevertheless have been quite free from the disease until even a year or two after their arrival in England, so that the disease has come to be erroneously attributed by the patient to the influence of the English climate.

Diagnosis.—When the eruption of Elephantiasis Græcorum is in the macular stage it may be mistaken for Erythema, for Pityriasis versicolor, or for a Syphilide, but the peculiar alteration in the sensibility of the discolored skin will at once serve to distinguish this disease from any other; later on it is almost impossible to confound it with any other eruption.

Prognosis.—This is always a most serious disease, and it terminates in most cases fatally. In some instances, however, it has been recovered from. Such an issue may be hoped for when the patient is young and vigorous and the disease has not already made much progress.

Treatment.—Many specifics for this disease have been brought forward but none of them has acquired anything like a lasting reputation, and it is more than doubtful whether any of them can be truly said to exercise control over the progress of the complaint.

The avoidance of such causes (indicated above) as are known to favor the progress of the disease. The internal administration of cod-liver oil, of arsenic, of iodide of potassium or iron, and the employment of stimulating applications to the stains or tubercles, and of caustics to the ulcers, are the best measures that can be adopted. When enteritis or diarrhœa have supervened the diet should be carefully regulated and the use of opium will be called for.

[*Leprosy* is included under the above account; although it may be questionable whether all the synonyms at the head of this article represent exactly the same disease. The greatest doubt, perhaps, attaches, in this respect, to the Norwegian *spedalsked.*[1] Many authors prefer the Greek term, *Lepra,*[2] as the generic name for the disorder called, above, Elephantiasis Græcorum.

Undoubtedly there has been, from the most ancient times, an affection involving both the general system and the skin, with which the name of leprosy has been long connected by general consent. From the 10th to the 16th century, there were hospitals for lepers in every country in Europe, in Great Britain[3] as well as on the Continent. Not improbably, other diseases were, during the middle ages, confounded with it. As, towards the end of the 16th century, leprosy became less frequent, and syphilis received more attention, some have supposed an identity between these two constitutional affections. This hypothesis, however, has not been established by any proof.

[1 See articles on this subject, in the Brit. and For. Medico-Chirurgical Review, 1850, p. 71; and April, 1858.—H.]

[2 Lepra, with the Greeks, meant a scaly disease of the skin. As stated by Hillyer (Diseases of the Skin, Amer. Edition p. 200), confusion was introduced through the use of the term elephantiasis in two different ways by the translators of the works of the Arabian writers, Avicenna, Rhazes, &c., into Latin. From that time the application of the name lepra, or leprosy, to the elephantiasis of the Greeks, became common.—H.]

[3 Simpson, Edinburgh Medical and Surgical Journal, 1841.]

A report of the investigations of a committee of the London College of Physicians,[1] in 1867, states the existence of leprosy at that time in the following localities: Abyssinia, Algeria, Arabia, Australia, Bokhara, Brazil, Cashmere, Cephalonia, Ceylon, China, Courland, Crete, Cape of Good Hope, Ægean Islands, Ecuador, Esthonia, Finland, Greece, Iceland, India, Isle of Bourbon, Java, Kamskatka, La Plata, Coasts of Northern Italy and Southern France, and elsewhere along the Mediterranean shores, Madagascar, Malta, Mauritius, Mexico, Morocco, Norway, New Grenada, Persia, Portugal, delta of the Rhone, Russia, Senegambia, Spain, Sumatra, Sweden, Syria, Venezuela, and the West Indies. The disease is also known to be far from rare in the Sandwich Islands.

Many of the above named places are upon or near the sea-shore. Several facts, especially in regard to the *spedalsked* of Norway and Sweden, appear to point to the habits (possibly the diet) of those who make their living as fishermen, as in some manner connected with the causation of leprosy. Yet all that can be predicated with much confidence is, as above said, that *hereditary transmission* and *climate* are its two chief elements of causation.[2]

Of recent reports and studies of leprosy and its treatment, reference may be made to the following: Dr. J. Laboute, of Mauritius,[3] has given an account of a number of cases occurring under his observation, of both tubercular and anæsthetic leprosy. Tilbury Fox[4] has narrated the history of the case of a boy aged 17, of English descent, but born in Bombay. Having been attacked with leprosy in Bombay, he recovered there, but the disease recurred in England. Jonathan Hutchinson[5] reported to the Royal Medical and Chirurgical Society a well-marked case, in which recovery took place. This patient was a Jewess, whose parents were born and resided in England. At the age of 32 she went to live in Jamaica. Twelve years later she returned to England with severe leprosy. At the time of J. Hutchinson's report she had been well of the disease for twenty years. He attributed her cure mainly to change of diet, especially the abandonment of fish.

An official report has been published[1] by J. D. Hillis, of the employment of *gurjun* oil in the treatment of leprosy, at the Leper Asylum, Mahaica, British Guiana. Experience at that institution has confirmed the favorable judgment of the late Dr. Dougall in regard to the power of gurjun oil over leprosy. Of thirty-two patients treated with it, twenty-five were much improved, and one recovered so far as to return to his family and friends. The gurjun oil is used both internally and externally.

The first recorded case of inherited leprosy in the United States is said to have occurred in Nebraska.[2] Dr. Hyde, Professor of Dermatology in Rush Medical College, Chicago, reports his treatment of the case of a man 43 years of age, a native of Sweden, two of whose brothers had leprosy in that country. The case of inheritance of the disease was that of his daughter, born in this country. Dr. Hyde mentions that both father and daughter improved perceptibly within a month, under the internal use of chaulmoogra oil, an ointment of the same (one part to four of lard) being also applied externally. According to Dr. Wyndham Cottle, chaulmoogra oil may be safely given in five-minim doses, gradually increased. A number of practitioners have reported favorably of this remedy, although it is not always successful.—H.]

Elephantiasis Arabum.

Synonyms.—Barbadoes-leg; Egyptian sarcocele; Lèpre tuberculeuse éléphantine; Hernie charnue; Elephas pachydermia; Bucnemia; Hypersarcosis; Febris erysipelatosa; Dal. fil (of the Arabians).

Definition.—Elephantiasis Arabum is a disease of the lymphatic vessels. It is characterized at first by a series of attacks of acute inflammation of the lymphatic vessels of some limited region, accompanied sometimes with erysipelatous inflammation of the skin of that region. These attacks succeed one another after distant intervals, and lead finally to a considerably swollen and indurated condition of the part affected.

With the Elephantiasis of the Greeks this disease has nothing in common but the name.

Causes.—The etiology of this disease is very obscure. Climate has undoubtedly a considerable influence in its production, since it is almost peculiar to tropical countries. It is especially common in certain parts; for example, Rio Janeiro and Barbadoes. From the latter place it

[1] Medical Times and Gazette, Feb. 23, 1867.]

[2] Fayrer has called attention to the fact that leprosy is unknown in certain districts in India where the favorite food of the people is decomposing fish, while it is common in the Himalayan region, where fish-eating is impossible. (Lancet, Feb. 15, 1879.)—H.]

[3] Edinburgh Med. Journal, Nov. 1878.]

[4] Med. Times and Gazette, Dec. 2, 1878.]

[5] Lancet, Feb. 15, 1879; also Brit. Med. Journal, 1879, p. 232.]

[1] Brit. Med. Journal, April 26, 1879.]

[2] Chicago Medical Journal and Examiner, December, 1879.]

derives its common English name. It has been attributed to the great diurnal variations of temperature that are peculiar to tropical climates—to the contamination of the atmosphere with the exhalations from decomposing organic matter. It may occur at all ages but is commoner with adults than with children. It affects both sexes indifferently. It is not an hereditary nor is it a contagious disease.

Description.—The disease commences with general febrile disturbance and acute pain in the part about to be affected, the inflamed lymphatics of which soon form tender swollen knotted cords. When the complaint occurs in the leg a hard knotted cord runs up from the ankle or knee as far as the groin, where it ends in the swollen glands; at the same time the skin of the affected part is commonly affected with erysipelatous inflammation.

The attack is attended often with vomiting and headache, and sometimes even with delirium, but in a few days the patient is well again, the only relic of the attack being a slight swelling of the affected part. After an interval, which varies from one to many months, the attack is renewed, and as the paroxysms are frequently repeated, and each time leave the affected part more and more swollen, the enormous solid swelling which distinguishes the disease is at last produced. It is not, however, until the disease has lasted many years that the swelling acquires any very considerable development.

There are many variations in the appearance of the swollen part: sometimes the swelling is uniform and rounded, sometimes in successive portions separated from each other by deep folds. On the leg these folds may cease at the foot, which retains its natural appearance, or the foot may be involved in the swelling; in the latter case the limb resembles the leg of an elephant—the swelling, however, never involves the sole of the foot, nor when the arm is affected does it ever extend to the palm of the hand.

In some cases the skin of the swollen part is thin, smooth, and polished, so that if the swelling be uniform it presents the same appearance as in ordinary œdema, but there is this difference, that in Elephantiasis the surface is harder and firmer, it does not readily pit on pressure. In other cases, especially after a paroxysm, the swollen surface may present a papular or a vesicular eruption. Sometimes the skin may be disfigured by a varicose state of the smaller veins, sometimes it acquires a scaly condition as in ichthyosis, sometimes it becomes covered with warty growths, which have been compared to syphilitic warts, and then deep cracks may be formed which become covered with crusts which, from time to time, become detached and are renewed. In such cases portions of the skin may ulcerate, or even large sloughs may be formed. Occasionally the lymphatic glands suppurate. When death results from the disease the patient sinks gradually, and at length dies of hectic fever.

The disease may occupy almost any part of the body. Thus it has been noted on the scalp, the ears, the neck, the trunk, the scrotum, the penis, the mammæ, the vulva, and the limbs. Its most favorite situations are the limbs, especially the lower limbs and the scrotum. When it occurs on the leg (its commonest situation), it is known as Barbadoes-leg. The next most frequent seat of the disease is the scrotum; when it affects this part it is known as Egyptian sarcocele; in this situation the swelling is often complicated by an abundant sebaceous exudation from the skin.

The scrotum affected with Arabian Elephantiasis sometimes attains enormous dimensions; thus it has been known to measure four feet in circumference, and to weigh as much as from seventy to eighty pounds.

The swelling of Arabian Elephantiasis is produced by a plastic exudation in the meshes of the subcutaneous areolar tissue which becomes developed into dense areolar or fibrous tissue. Sometimes the exudation is deposited also in the meshes of the intermuscular areolar tissue and the muscles become atrophied and undergo fatty degeneration.

Diagnosis.—By a reference to what has been said in our description of Elephantiasis Græcorum it will be seen that Elephantiasis Arabum can scarcely be mistaken for it.

From œdema the swelling of Elephantiasis Arabum may be readily distinguished by its hardness, by its abrupt margin, and by the history of a series of erysipelatous attacks having preceded it. When, however, the skin has undergone the alterations we have described as common in Elephantiasis Arabum, the swelling no longer presents the appearance of mere œdematous infiltration.

Prognosis.—The disease has an indefinite duration. In its early stage a favorable termination may sometimes be hoped for, but when of long standing, Arabum Elephantiasis may be regarded as incurable.

Treatment.—In its early condition, when the disease consists of a series of acute inflammatory attacks, these should be combated by a restricted diet, the application of leeches around the inflamed part, and continued poulticing.

In the later acute attacks dry cupping is useful when permanent swelling has become established. Frictions with mercurial ointment will often produce decided

benefit. Iodine or iodide of potassium ointment have been recommended; so have blisters and cauterization of the skin, but any measures that have the effect of inflaming or irritating the skin must be regarded as of doubtful use. Wet cupping has been recommended.

Well-regulated pressure constantly kept up on the swollen part is often of considerable service. The effect of the vapor-douche has been praised.

The internal treatment best calculated to reduce the swelling of Elephantiasis is the prolonged systematic administration of mild purgatives, and of moderate doses of the iodide of potassium.

Amputation is occasionally practised for the relief of Elephantiasis of the leg, but except in cases where the disease is very far advanced is not to be recommended; the removal of the whole of the diseased part does not necessarily effect the cure of the disease, since after amputation it has been known to return in other remote parts of the body.

Ligature of the main artery of the affected limb (for instance of the femoral when the leg is affected) is apparently a preferable procedure and has occasionally been followed by good results.

[*Scleroderma.*— This affection resembles Elephantiasis Arabum in its apparent nature, but differs in being general over the body, instead of local only; and, also, in the enlargement never attaining great dimensions. Scleroderma was first described by Curzio, in 1755. It is rare; less than fifty cases having been recorded in a century.[1] Most of the examples of it (nearly two-thirds) have occurred in women.

Its invasion is commonly gradual; several cases have been fatal after a number of months or years. Pigmentation often, but not always, accompanies the thickening and hardening of the skin. The general health may be, for a long time, not impaired. Hebra divides the cases of scleroderma into two kinds: *sklerema elevatum* and *sklerema atrophicum*. The latter he considers to be always incurable. Madar[2] compares this affection, in regard to its pathology, to progressive (pseudo-hypertrophic) muscular atrophy. Kaposi and others attribute it to lymphstasis, similar to that of Elephantiasis Arabum.—H.]

Frambœsia.

Synonyms.—Yaws; Sibens or Sivvens; Pian; Schwammförmige; Lepra fungifera; Mycosis.

Definition.—The Yaws is a contagious disease, appearing once only during life, running a definite but chronic course, and characterized by the eruption of a number of raspberry-like tumors on certain parts of the skin.

Causes.—The disease is indigenous in Central Africa (where it is known as the Yaws), hence it has been conveyed to the West Indies (where it is called Pian). It is known also in the northern parts of the British Islands under the name of Sivvens. It is commoner with children than with adults, and with negroes than with white persons. It is propagated by contagion of the matter discharged from the eruption; it is therefore inoculable. It is believed that the disease is extensively spread by the medium of flies that have lit on the sores of affected persons.

Description.—The period of incubation of the disease is about two months. It appears first as small red points like fleabites, these soon rise into pimples, which extend till they attain on an average half an inch in diameter. As these tubercles enlarge, their surface becomes covered with a scab. Beneath this seat a fungous growth consisting of florid prominent granulations springs up. From this fungous growth the disease derives its name Frambœsia (*framboise*, a raspberry). Two or three months elapse before the red point attains the raspberry-like condition. While the first crop of tubercles is attaining maturity, a second crop will sometimes make its appearance. After the eruption has continued some time it usually happens that one of the tubercles will increase considerably in size, so as to become much larger than any of the others; —it may attain a diameter of a couple of inches. This, which is called the Mammapian, or Mother-yaw, becomes corroded and assumes the form of a depressed ulcer, while the other yaws continue raised; it generally leaves a scar behind it.

After remaining stationary for some time the raspberry-like tumors become atrophied, gradually sink to the level of the skin and disappear, leaving sometimes, but not usually, a faint scar.

When the tumors are very numerous they are generally smaller than when they are few. The course of the disease is very slow, extending in the case of adults generally over a year, or even a year and several months; in children its duration may be stated at seven or eight months.

The eruption may affect any portion of the skin, but the parts chiefly affected are the scalp, face, axillæ, groins, and the neighborhood of the genitals and anus.

The little tumors cause no pain except when they occupy the palms or soles; the unyielding epidermis here binding them down in these situations; they are called crab-yaws.

[1 Day, Am. Journal of Med. Sciences, April, 1870; Irish Hospital Gazette, Feb. 15, 1873.]

[2 Vierteljahresschrift für Dermatol. und Syphilis, 1878.]

The yaws are not necessarily attended with any constitutional disturbance. Sometimes at their first appearance there is slight feverishness, and sometimes their decline is attended with more or less general debility.

Diagnosis. — Frambœsia cannot very well be mistaken for any other disease.

Prognosis.—In cases of this disease it may always be anticipated that after a duration of several months the disease will disappear without any serious result.

Treatment.—There are no means of cutting short the disease. It must be allowed, within certain limits, to take its own course.

So long as fresh tubercles continue to appear the treatment should be limited to such measures as cleanliness and a nutritious diet.

When the disease has begun to decline, the usual practice is to administer sudorifics, such as the compound decoction of sarsaparilla, antimonial preparations or sulphur—and such tonics as quinine, iron, or the mineral acids.

As local applications to the tubercles themselves, mildly stimulant applications, such as ointment of the oxide or of the subiodide of mercury may be used. If cauterization be required, the arsenical paste of Frère Côme or the acid nitrate of mercury are the favorite applications.

Pellagra.

Synonyms.—Elephantiasis italica ; Dermatagria ; Pellarina ; Malattia di miseria ; Mal. rosso ; Mal de misère.

Definition.—Pellagra is a chronic periodic disease peculiar to Northern Italy, Southern France, and a part of Spain, characterized by red or chocolate-colored desquamating patches on the exposed parts of the skin, and disorder of the digestive organs and of the nervous system.

Causation.—Pellagra has been attributed to "an endemic and special influence of the soil." It is often hereditary. It is a little more common with women than men. It generally affects middle-aged persons. It is almost confined to the very poorest classes, hence its name "Mal de misère." Unhealthy miasmata, excessive bodily labor, insufficient or unwholesome food, crowded and ill-ventilated dwellings, mental anxiety and distress, have been enumerated as predisposing causes of this disease. It has been attributed to the use of maize as a common article of diet, and especially to unripened maize, which is often attacked by the Sporiosorium maïdis to which fungus a special influence has been ascribed. Insolation is believed to be an exciting cause. The disease is not contagious.

Description.—Pellagra (pellis ægra, diseased skin) is a general disease which begins (usually in the spring), by malaise, a feeling of depression, both mental and bodily, an anæmic aspect and various symptoms of digestive derangement.

As the spring advances and warm weather commences an eruption appears, which affects especially those parts of the body that are left uncovered, and so exposed to the direct rays of the sun, viz., the face, the neck, and chest, the forearms, and the backs of the hands, the lower parts of the legs and the upper surfaces of the feet.

The eruption may consist either of patches of dark erythematous redness (without swelling) of the skin, with generally slight scurfiness, or of chocolate-colored stains accompanied with a scaly condition of the cuticle resembling psoriasis or ichthyosis. Sometimes the eruption is of an erysipelatous character with vesicles or blebs, and a burning pain, which end in exfoliation of the cuticle.

During the progress of the eruption the general symptoms continue. The appetite is either wanting or excessive, the bowels constipated or loose with offensive discharges, the lips and mouth are livid and sometimes ulcerated.

Towards the beginning of autumn the skin affection disappears and the general symptoms become less marked. The patient is in every way better till the return of spring, when he becomes worse than before and the eruption reappears. The general cachexia deepens and the disorder of the digestive system is aggravated. More than this, disease of the nervous system is now superadded, pains in the back and limbs, cramps in the legs and other spasmodic symptoms, great loss of muscular power, amounting almost to palsy, especially in the lower limbs, vertigo, dimness of sight, profound sadness, and sometimes epileptiform attacks occur. As winter again approaches, the patient again gets better, but his improvement is not so marked as before ; the following spring his disease again becomes aggravated, and so every succeeding summer he becomes worse, until at last he sinks with symptoms of low fever. Those who long withstand the disease become demented. The duration of the disease varies from two or three, to ten or twelve years.

Diagnosis.—The limited habitat of this disease, the class of persons to which it is restricted, the time of year at which it is most developed, and the conjunction of the eruption with the general symptoms of this disease greatly facilitate its diagnosis.

Prognosis.—In its earlier stage a favorable issue may be hoped for under the employment of suitable means, but when it has once become far advanced the disease is generally fatal.

Treatment.—This is limited to the treatment of the various symptoms as they arise, on general principles, and to the adoption of hygienic measures.

Warm-baths, a nutritious diet, the avoidance of exposure to great heat, the transportation of the patient to some part where the disease is not endemic. In short—the removal of the causes which we have enumerated above as predisposing to the disease.

Malum Alepporum.

Synonyms.—Aleppo ulcer; Bouton d'Alep; It. mal d'alepo; Haleb Choban; Habtil Senne; Aleppo evil.

Definition.—Aleppo evil is a chronic disease peculiar to Aleppo and its neighborhood, occurring only once during life, characterized by the appearance of one or more flat tubercles which ulcerate and leave a cicatrix.

Causes.—The causes of the disease are obscure; it is not inoculable, neither is it contagious. It is endemic not only at Aleppo, but also at Bagdad, and at various cities on the borders of the Tigris and Euphrates.

Description.—The disease consists in the eruption of one or several tubercles. They may appear at any part of the body, but are generally confined to the face and extremities. The face is their favorite situation.

The number of the tubercles varies; there may be only one, or there may be as many as a hundred; generally there are but two or three. When there is but one it is called the "male tubercle." When one or more large tubercles are surrounded by a number of little ones the disease is called by the Aleppians the "female tubercle."

The tubercle at first is very indolent, and is attended neither with pain, heat, nor itching. After spreading for some months without a proportionate increase in height, it at length becomes extremely painful. Suppuration takes place, and an ulcer is found which discharges a thick offensive purulent matter which dries into a scab. The ulcer itself is superficial, uneven, and florid, and varies in diameter from half an inch to three or even four inches.

The scab at first is moist and is repeatedly cast off and renewed; but after a few months it becomes dry and adherent, and cicatrization takes place at the end of a year. Sometimes the face is greatly disfigured by the scar.

The disease attacks all ages and both sexes. But it appears generally at the age of one or two years. It is said that no inhabitant of Aleppo ever reached his tenth year without being affected with this "evil," and marked in the face. It attacks strangers who dwell in Aleppo as well as natives, but then less frequently fixes on the face. Instances are related of Europeans who had resided for a time at Aleppo being attacked many years after they had left the place. The dogs at Aleppo are subject to this disease.

Prognosis.—The disease may be expected to last in all about a year without interfering in any way with the general health, but it always leaves behind it a scar which is often a very disfiguring one.

Treatment.—This is limited to emollient applications, the observance of cleanliness, and the occasional sparing use of caustics.

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